

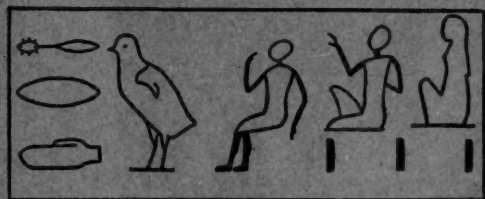
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# CHILD DEVELOPMENT



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WISHES, FEARS, INTERESTS, AND IDENTIFICATIONS  
OF DELINQUENT BOYS<sup>1</sup>

GEORGE S. SPEER<sup>2</sup>

The delinquent child is one who is maladjusted, not only in terms of external objective behavior, but also in terms of his desires, aims, needs, and the direction of his interests. These desires and aims are the product of his environments, his experiences, his capacities, and his reactions to these factors. (2) The specific form of the delinquencies in which the individual expresses his inner turmoil, depends to some extent upon opportunity. It seems logical to suppose, however, that the largest factor in determining the type of delinquent act would be the sort of conflict and maladjustment which the individual is expressing.

If this assumption is correct, differences in type of delinquency should be matched by differences in the desires, wishes, ideals, and goals, of the individuals involved. The present paper reports an attempt to investigate this hypothesis.

As a part of the routine procedure in examining boys committed to the Berkshire Industrial Farm for various delinquencies, a questionnaire has been devised which is intended to reveal the direction of the individual's wishes, fears, identifications and interests. As Washburne (4) has indicated, when cooperation is carefully solicited there is very little tendency on the part of adolescent subjects to misrepresent their wishes. An effort has been made each time to elicit truthful replies to the different items on the questionnaire, and the replies were later discussed with each boy. Sincerity or untruthfulness are soon discovered by this procedure, and it is felt that the present replies represent sincere efforts to reveal the wishes, fears, and ideals of each of the subjects.

The population for this study consists of 100 boys, aged 11 to 15, with the mean age at 13.2. Forty-eight were committed to Berkshire Industrial Farm for truancy from school and absconding from home; fifty-two were committed for petty theft. The I.Q. ranges from 63 to 140, the mean being 97. There are no significant differences between the two groups, in age or intelligence.

WISHES

Goodenough (1) long ago recognized this significance of children's wishes in the diagnosis of the maladjustments, and as additional light on their attitude towards their problems. Our own question differs somewhat from hers, and has been made as simple and direct as possible without loss of meaning: "If by some power you could have your first three wishes granted, what would they be?"

The results are shown in Table 1. It is interesting to note that the wishes fall into four distinct groups, which are very similar to the four-fold classification of Thomas (3). The wish to be home, variously expressed, seems quite definitely to be a wish for security. The wishes classified here as the desire to do

<sup>1</sup> This study was conducted at the Berkshire Industrial Farm, Canaan, N.Y.

<sup>2</sup> From Children's Service League, Springfield, Illinois.

TABLE 1

## Classification of Three Primary Wishes

Type of Wish	Group							
	Truant				Theft			
	Wishes			Total	%	Wishes		
	1	2	3			1	2	3
To be Home	6	4	2	12	8.4	12	8	6
To Have Material Things	16	10	8	34	23.6	6	14	12
To be Someone	16	22	24	62	43.0	20	20	26
To do Things	10	12	18	36	25.0	20	20	26
Total	48	48	48	144	100.0	52	52	52

things, is very similar to the wish for new experience. The wish to be someone of importance seems likely to represent the desire for mastery. The wish to have material things corresponds less closely to Thomas' scheme, but is somewhat similar to his desire to attract others.

Not unexpectedly, the Truant group shows very little desire to be at home. Although there are more than twice as many expressions of the wish to be at home in the Theft group, this is a small part of the total expression of their wishes. Very little difference is found in the desire for material possessions, either in the frequency with which the wish is expressed, or in the type of thing that is wished for.

Significant differences in the wishes expressed are found in their attitude towards achievement and activity. The Truant group is definitely more interested in becoming a person of importance; the Theft group is much more interested in doing things. It seems possible that this is an expression of very real differences in attitude. The truants, who have run away from their difficulties in the past, would like to be someone of importance, but do not express any realization of the effort involved. The Theft group is concerned more with the immediate problems of activity which they feel would be congenial.

## FEARS

It was felt that the expression of fears might suggest some of the underlying causes of the personality disorder and maladjustment. After some experimentation, the question was so phrased that even the most sensitive might answer it without loss of prestige. "Even though you are not really afraid, write the three things of which you are most afraid." When some subjects balked at this form, they were requested to write the things which they would be afraid of if they were afraid of anything. Even this did not elicit responses from many of the subjects, and a category of "no fear" had to be included, though it is felt that in the majority of cases this refusal to name the fears was in itself an expression of fear: fear of ridicule or contempt on the part of the examiner. This feeling seems supported by the division of the boys into the two groups. The Truant group has three times the number in the Theft group who refuse to express fears, and also the greater number of those who express a fear of being injured.

If the fear of animals, and the fear of being hurt, are considered together, as seems logical, the differences between the groups become more apparent. The Theft group expresses a fear of its own probable future behavior, generally expressed as a fear of personal failure. The differences in the other fears are



TABLE 2

## Classification of Three Primary Fears

Type of Fear	GROUP									
	Truant					Theft				
	Fears			Total	%	Fears			Total	%
	1	2	3			1	2	3		
Of Animals	24	16	20	60	41.6	16	14	2	32	20.6
Of Being Hurt	10	12	6	28	19.4	2	4	7	13	8.3
Of Own Behavior	0	4	2	6	4.8	16	18	19	53	33.9
Of Natural Forces	2	2	0	4	3.3	8	2	2	12	7.6
Of Illness and Death	2	2	6	10	6.6	4	2	8	14	8.9
Uncongenial Occupation	4	2	2	8	5.6	2	2	2	6	3.8
Miscellaneous	0	2	2	4	3.3	4	3	8	15	9.7
No Fear	6	8	10	24	15.3	0	4	4	8	5.1
Total	48	48	48	144	99.9	52	52	52	156	99.9

not statistically significant.<sup>1</sup>

## POSITIVE IDENTIFICATION

Who is the ideal of the delinquent boy? With whom would he change places if he could? To investigate this aspect of the mental life of this group, they were asked, "If you could be like anyone, real or imaginary, living or dead, whom you have read of, heard of, or imagined, whom would you like most to be like? Why?" The results are presented in Table 3.

TABLE 3

## Classification of Positive Identifications

Type of Identification	GROUP			
	Truant		Theft	
	Number	%	Number	%
Personal Characteristics	26	54.2	12	23.0
Fame and Reputation	8	16.6	0	0.0
Occupation	12	25.0	36	69.2
None	2	4.1	4	7.7
Total	48	99.9	52	99.9

Inspection of the results indicated that it is the second part of this question which is the more important. Many chose the same historical or literary figure, but for quite different reasons. Washington, for example, was selected because "he was a good man", "because he was a famous president", "because he was a great general and won a lot of wars". For this reason the results are presented as indicating the reason for identifying with the individual's choice, rather than classifying the choices themselves.

Occupational reasons for identification are outstanding in the Theft group, nearly three-fourths of the group giving this reason. None of the group mentions fame or reputation as a reason, which seems equally significant. This group seems consistently interested in doing things, in forms of behavior and activity. The Truant group, on the other hand, is equally consistent, giving as reasons for its choice the personal characteristics and the fame and reputation

<sup>1</sup> It is interesting that only two boys expressed a fear of persons. One was afraid of his mother, the other of foreigners.

of the individuals. This group seems much less interested in working, and much more interested in being a well-known or admired person.

#### NEGATIVE IDENTIFICATION

The reverse of the third question was also included, to find not only those whom the subject would like to be like, but whom he would not like to be like. The question was, "If you had to choose someone to be like, who is the last person you would choose? Why?" The results are tabulated in Table 4.

TABLE 4  
Classification of Negative Identifications

Type of Classification	Group			
	Truant		Theft	
	Number	%	Number	%
Occupation	12	25.0	7	13.4
Personal Qualities	8	16.6	32	61.5
Criminal Behavior	26	54.1	11	21.1
No Reply	2	4.1	2	3.8
Total	48	99.8	52	99.8

On this question the attitudes of the groups are reversed. The Theft group shows a decided interest in the personal characteristics of the individuals they dislike, while the Truant group displays very little interest in these qualities. The latter group reveals a very decided interest in the behavior of the individuals they dislike. Such remarks as "He steals", "He kidnapped", "He murdered", indicate a repulsion from such activities. The Theft group evidences little interest in this sort of behavior. The differences in their feeling concerning occupational dislikes are not statistically significant.

#### DESIRED ACTIVITIES

Are there significant differences in the activities which would be chosen by these boys, if their choice were free? In order to throw some light on this aspect of the direction of their interests, each boy was asked, "Of all the possible ways of spending your time you have ever heard of, read of, or imagined, which would you like best to do? Why?" The results are presented in Table 5.

TABLE 5  
Classification of Desired Activities

Type of Activity	Group			
	Truant		Theft	
	Number	%	Number	%
Occupation or Profession	9	18.7	33	63.3
Recreation other than Games	8	16.7	12	23.1
Adventure	8	16.7	0	0.0
Games and Sports	23	47.8	7	13.5
Total	48	99.9	52	99.9

Again the Theft group shows a very decided and significant interest in occupation, while the Truant group displays very little interest in work, and a definite

interest in sports, adventure, and other forms of recreation. It is interesting that not one of the Theft group showed an interest in adventure. Whether the interest in adventure shown by the Truant group is responsible for the truancy, or is a product of it, is a problem still to be investigated. Certainly the majority of these boys have had adventurous experiences during their truantries.

#### UNDESIRABLE ACTIVITIES

If there are important differences in the desired activities of these groups, those activities which are undesired and disliked should also reflect their difference in attitude and viewpoint. Question 5B was, "Which would you like least? Why?" The results are presented in Table 6.

Again, there are decided differences between the two groups. Statistically, none of these differences are truly significant, but when they are considered in the light of the previous results, it is felt they are important. These results need perhaps more interpretation than the former tables.

Apparently there is no difference between the Truant and Theft groups in their dislike for work or particular occupations. However, the reason for the expressed dislike indicates a sharp difference in attitude which is difficult to express graphically. The Truant group does not want to work; the Theft group does not want particular types of work. In other words, the former group dislikes work in general, the latter group is still concerned with finding a congenial type of work in which achievement is possible.

This difference in attitude is consistently expressed in another way. The Theft group definitely dislikes doing nothing, though the Truant group has little antipathy towards inactivity. In the field of recreation, both groups express

TABLE 6  
Classification of Undesired Activities

Type of Activity	Group			
	Truant		Theft	
	Number	%	Number	%
Work or Occupation	17	35.5	18	34.6
Recreation	21	43.7	4	7.6
Idleness	6	12.4	25	48.1
Miscellaneous	4	8.3	5	9.6
Total	48	99.9	52	99.9

definite dislikes for particular forms of recreation or games. The Truant group, however, much more frequently expresses a dislike of particular forms of recreation. Considered with the activities desired, as shown in Table 5, this would appear to indicate a greater concern with recreation and sports on the part of the Truant group.

#### SUMMARY AND CONCLUSIONS

One hundred adolescent delinquent boys, who had been committed to the Berkshire Industrial Farm, 48 for truancy, 52 for petty theft, were individually examined in respect to their wishes, fears, interests, and identification with heroic or famous figures. Significant differences were found between these groups, which it is felt are important in explaining the particular type of delinquency of which the boys are guilty.

It is concluded that, of this group:

1. The Truant group is much more interested in becoming a person of importance; the Theft group is much more interested in congenial activity.
2. The Theft group is afraid of failure, the Truant group of personal injury.
3. The Theft group identifies itself with heroes or famous people because of their activity or occupation; the Truant group identifies on the basis of the personal characteristics and fame of the individual.
4. The Theft group negatively identifies on the basis of personal characteristics; the Truant group negatively identifies on the basis of activity or behavior.
5. The Truant group would most like to spend its time in sports, adventure, and recreation; the Theft group prefers work.
6. The Truant group dislikes work in general; the Theft group dislikes particular types of work.
7. The Theft group definitely dislikes being idle; the Truant group expresses little dislike for complete inactivity.

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# EFFECT OF PICTURES ON RECALL OF STORIES TOLD ORALLY<sup>1</sup>

DOROTHY TILDEN SPOERL

## PURPOSE

The purpose of this study was to determine the effect of the presence of pictures on the amount of a story that a group of children could recall; to determine whether they would remember the story more clearly when accompanied by pictures, or whether the pictures, by their own intrinsic story-telling power, would detract from the oral story.

It was further hoped that it would be possible to determine whether any confusions were caused by the pictures, or if, on the other hand, they would tend to clarify points which would otherwise be confusing.

## METHOD

In the preliminary study an attempt was made to secure immediate recall on the part of the children; in the main body of the study recall was delayed.

The group of children used in the study was an "auxiliary class" of a large city elementary school. With two exceptions the children were of Italian parentage and came from Italian-speaking homes. The intelligence quotients of the group (as measured by the tests used in the city psychological laboratory) ranged from 52 to 98. For two of the children it was not possible to obtain the city score.

The children were also given the Goodenough Drawing Test, by which the intelligence quotients ranged from 51 to 113. In the case of the child securing 113, it seems likely that the city score is more accurate. In the other cases the comparison between the two scores showed a surprising similarity, giving a correlation of +.73. Seven of the group were boys and eleven were girls. The chronological ages ranged from 6;9 to 14 years. The Goodenough mental age range was from 4;9 to 10;9.

The subjects were divided into three groups as follows:

<u>Group</u>	<u>Number</u>	<u>Average I.Q.</u>	<u>Average M.A.</u>
I	5	71.6	5;10
II	8	78.	7;4
III	5	83.	8;4

In the study of immediate recall the two stories were told to the children in groups, then repeated to the examiner, who took the story in shorthand. As a break between the telling and retelling, each child was asked to draw anything in the story which he thought was interesting.

In the study of delayed recall the story was told to the class as a whole, one story on each of two consecutive days. One week later the children, divided into groups, repeated the story to the examiner as in the immediate recall study.

<sup>1</sup> The author is under obligation to the school department of the Springfield, Massachusetts Public Schools, to Mr. Frank Doane, principal of the Howard Street School, and to Miss Minnie Estabrooks, for cooperation in making this experiment possible.

## STORIES USED

In the study of immediate recall different material was used with groups I and II than with group III. Group I and group II had Elsa Beskow's PELLE'S NEW SUIT told with pictures, and Marjory Flack's ASK MR. BEAR told without pictures. Group III (who knew one of these stories) had two chapters of Elizabeth Orton Jones' RAGMAN OF PARIS told without pictures, and two other chapters told with pictures.

In the study of delayed recall the same stories were used for all groups. In each contrasted set (that is, the story with and the story without pictures), the stories were by the same author. This was done to have the stories as similar in quality as possible. Stories used were Marjory Flack's WAIT FOR WILLIAM and WHAT TO DO ABOUT MOLLY, and Maj Lindman's SNIPP, SNAPP, SNURR AND THE BUTTERED BREAD, and SNIPP, SNAPP, SNURR AND THE RED SHOES.

## RESULTS

The following table will show the results of the study. In each case the number of items in each story was listed, and the stories as retold by the children were checked against these lists. The percentage refers to the percent of items in the original story recalled by the children.

## Immediate Recall

Group	With Picture		Without Picture	
I	Pelle's New Suit	48%	Ask Mr. Bear	67%
II	Pelle's New Suit	78%	Ask Mr. Bear	82%
III	Ragman of Paris	23%	Ragman of Paris	36%

If all the percentages for stories with pictures are averaged and compared with all the percentages for stories without pictures, we find in the case of immediate recall with pictures 49.6% retention, and in immediate recall without pictures, 61.6%.

## Delayed Recall

Group	With Picture		Without Picture	
I	Buttered Bread	37%	The Red Shoes	22%
I	Wait for William	27%	What to Do About Molly	27%
II	Buttered Bread	66%	The Red Shoes	57%
II	Wait for William	45%	What to Do About Molly	40%
III	Buttered Bread	59%	The Red Shoes	60%
III	Wait for William	43%	What to Do About Molly	35%

For Group I there is a tie in the case of the two Flack stories, each having a 27% recall. In Group III the two Lindman stories have a difference of only 1%. However, if the average for all the stories is taken we have the following group averages:



Group I:	with pictures, 32%	without pictures, 24.5%
Group II:	with pictures, 55.5%	without pictures, 48.5%
Group III:	with pictures, 51%	without pictures, 47.5%

The total average for the three groups would be: Percent recalled when there were pictures, 49.1%; and percent recalled without pictures, 40.1%. It will be noted that these results are the reverse of those in the study of immediate recall.

#### Errors of Reproduction

The errors made in retelling the stories do not seem important. In the story about the RED SHOES, Group II said that the shoes in the story had red "ribbon" rather than "lining." In the story about ASK MR. BEAR, the same group could not understand the word "feathers," calling it "leathers" and "weathers;" the word obviously had no meaning.

In the story of PELLE'S NEW SUIT both groups I and II were confused by the words "weave," "card," "spin," generally substituting the word "sew." They also called "dye" "paint," and were occasionally confused as to whether the story had mentioned cows or pigs (both being in it in different places.)

#### Confusions

The confusions seemed more significant. Group I was confused as to the process of butter-making, maintaining that Mother made the butter from grass. A study of the pictures shows the intermediate picture of milking the cow to be less vivid, especially as regards participation by the story-children, than the one where they are haying, or Mother is churning. This may explain the confusion.

Groups II and III were confused in the story of WHAT TO DO ABOUT MOLLY, believing she was tied to a tree rather than to a wharf. It seems clear that they did not understand the meaning of the word "wharf."

#### Additions

Only one addition was made in the case of a story without pictures. In WHAT TO DO ABOUT MOLLY the children ended the story with: "Father said, 'This is a good dinner.'"

Four additions were made in the story WAIT FOR WILLIAM. One child said: "There was a balloon man. She wanted a balloon." (There is none in the story, but it is in a picture.) When the story-children say "Look at William," one child substituted: "Who put you up there?" (He is high on the elephant's back in the picture.) They also said: "They pushed him home on his scooter;" where-as he rides it himself. And they ended with: "Mother, I went to the circus." It seems obvious that the first two additions were caused by the pictures. In PELLE'S NEW SUIT they end the story (Group I) with the phrase: "He went to church." The story mentions that it is Sunday, but the final picture shows everyone in his Sunday best. There is no church in it, however.

#### CONCLUSIONS

Although this is a preliminary study and should be repeated both in another "auxiliary class" and in a class of normal children of similar mental age, it seems reasonable to make the following tentative conclusions:

1. The pictures used with a story are vivid enough to interfere with the

immediate recall of the story.

2. In the case of delayed recall, the stories which were accompanied by pictures are more vividly and accurately remembered.

3. A study of confusions would lead to the conclusion that pictures can do away with errors by defining unknown words (as would have been true of the wharf in WHAT TO DO ABOUT MOLLY), but will not do so unless the items are pointed out when the story is told, as is shown by the confusions about "carding," "weaving," etc. in PELLE'S NEW SUIT, which are illustrated in the picture. In other words, the pictures will not clear confusion by their own presence; the teacher or story-teller must point out some of the details.

4. In delayed recall the memory of particularly vivid pictures may serve to cover intermediate steps (this perhaps would not be as true for normal children), as in the case of the "butter is made of grass" confusion on the part of the children in the story SNIPP, SNAPP, SNURR AND THE BUTTERED BREAD.

COMMENTS UPON J. M. SMITH'S WORK, "THE RELATIVE BRIGHTNESS  
VALUES OF THREE HUES FOR NEWBORN INFANTS"

ALBRECHT PEIPER<sup>1</sup>

Translated by

KARL C. PRATT

In her work Smith<sup>2</sup> criticizes my researches "Über die Helligkeits- und Farbenempfindungen der Frühgeburten"<sup>3</sup>. She reproaches me with "The small number of experiments and the inconsistency between his data and some of his conclusions from them."

The most important objection is directed against my sentences: "Upon dark-adaptation the relative brightness-value of colors is shifted toward the violet end. The Purkinje phenomenon is thus already clearly demonstrated at this stage of development." Against this Smith makes the following objection: "The curves showing the relative brightness of the four colors for the two subjects under the two conditions are presented in Figure 3. It will be seen immediately that the point of highest brightness after dark-adaptation for both infants is at the red. The shift toward increased brightness at the blue end, asserted to occur by Peiper, is not apparent in his data or curves. Neither is the highest brightness for the infants and for the adult at the same point after dark-adaptation. The characteristic of the Purkinje phenomenon is that the relative brightnesses of blue and green are increased by dark-adaptation, while those of red and yellow are decreased. Peiper's own results fail to prove the Purkinje phenomenon at this stage of development. ..." (p. 100)

To this I make the following observation. On page 15 of my work I had described the effect of dark-adaptation as follows: "As a glance at the curves shows, the stimulus relation of the colored glasses to one another<sup>4</sup> has completely altered. Red and yellow have decreased markedly while green and blue have maintained the same position with respect to white. One thus sees basically the same behavior in the premature infant as in the adult, a typical Purkinje phenomenon."

The Purkinje phenomenon consists in the fact that in dark-adaptation the relative brightness value of colors to one another is shifted. Red thereby becomes relatively darker than blue or -- what is the same thing -- blue becomes relatively brighter than red. If, for example, a given red and a given blue are selected and under illumination and light-adaptation the red appears brighter than the blue, then, upon lowered illumination and under dark-adaptation there will be a change in the opposing brightness-values under conditions so rigorous that now the red appears darker than the blue (or the blue brighter than the red).

<sup>1</sup>From Wuppertal, Germany.

<sup>2</sup>Smith, Josephine: The Relative Brightness Values of Three Hues for Newborn Infants. [In] Wenger, M. A., Smith, Josephine, Hazard, Charles, and Irwin, Orvis C.: Studies in Infant Behavior III. Univ. Iowa Stud., Stud. in Child Welfare, 1936, 12. Pp. 207 (p. 91-140).

<sup>3</sup>Archiv für Kinderheilkunde, 1927, 80, 1-20.

<sup>4</sup>In the original. (Not emphasized in print)

Thus by relative brightness-value of colors in the Purkinje phenomenon one means the relative brightness-value of colors to one another, and not, as Smith in her criticism seems to assume, the relative brightness-value of colors with respect to white light. That the relative brightness-value of colors to one another is most distinctly shifted, follows from the curves and figures which Smith (p. 101) cites as counterevidence from my work. In the case of Elfriede, for example, yellow under light-adaptation is about four times as bright as blue, under dark-adaptation on the other hand it is only slightly brighter. In the case of Michel, yellow, under light adaptation, is exactly four times as bright as blue, under dark-adaptation even somewhat darker. With respect to red and blue the relative brightness-value of the colors to one another has been shifted in the same direction. Therefore the Purkinje phenomenon is demonstrated in those curves and figures.

Smith has further uttered the reproach that I carried out too limited a number of investigations. I therefore call attention to an important difference between our two works: In my work every single child in every single investigation behaved basically as every other child. Therefore I did not pursue the studies further. Smith, on the other hand, reports upon average results from a larger number of children studied. If I understand Smith (p. 125) correctly, in the comparison of the sexes the averages of all the investigations have indeed behaved differently, but individually many boys have reacted like girls and conversely many girls have behaved like boys. But if, according to Smith, newborn boys are totally color-blind and girls partially color-blind, then the reactivity of every single boy must differ from that of every single girl.

Without criticizing Smith's work in detail I should like to state another consideration. The adaptation-state of the eye, which influences the brightness-value of colors, is not changed quite so rapidly upon a change in illumination. I therefore brought the children into the dark-room at least one hour prior to studying them under dark-adaptation. Smith, on the other hand, introduced dark-intervals of approximately five minutes between the different color experiments (which lasted five minutes) and compared the motility during the five minute experiments. During the dark-experiment the child's eye adapts to the dark, during the color-experiment it adapts to the light. But we cannot determine the brightness-value for an eye while its adaptation-state is changing; for the brightness-value depends upon the adaptation-state.

Upon this occasion I refer to my article "Über das Unterscheidungsvermögen des Kleinkindes."<sup>5</sup> While I established conditioned reflexes to colors, and thereby took into consideration their relative brightness-value, I was able to demonstrate that red, yellow, green and blue could be discriminated in about 30 degrees of brightness at the beginning of the third year of life; that therefore the child at this time cannot be totally color-blind. As I showed further, there exists at this time no red-green or blue-yellow blindness. With the aid of conditioned reflexes I succeeded in demonstrating structures (reacting) to pure colors.

<sup>5</sup> Jahrbuch für Kinderheilkunde, 1927, 117, 350.

# REPLY TO PEIPER <sup>1</sup>

JOSEPHINE M. SMITH

Professor Peiper has invited me to comment upon his reply to an analysis which I made of his data on the dark adaptation of the eyes of premature infants, and to his criticism of my work. I wish to thank him for his courtesy and hope that the accompanying remarks may be taken in the same friendly spirit of cooperation toward the solution of the problem which Professor Peiper has shown.

Peiper states in his reply, "The Purkinje phenomenon consists in the fact that in dark-adaptation the relative brightness value of colors to one another is shifted. Red thereby becomes relatively darker than blue or — what is the same thing — blue becomes relatively brighter than red." (p. 299) With both statements I am in accord. Moreover, Peiper's data on the premature furnish an illustration of the first. The following tabulation gives the average values of Peiper's experiments (relative brightness expressed in per cent):

		Relative Brightness Value			
		Blue	Green	Yellow	Red
Elfriede	Light-adapted	5.6	1.7	22.7	15.3
	Dark-adapted	2.8	1.85	3.5	4.8
Michel	Light-adapted	8.5	4.0	32.0	22.7
	Dark-adapted	7.8	7.8	6.6	10.0

In light-adaptation the values for red and yellow are much larger than for blue and green, while in dark-adaptation the values for the hues are very similar.

However, the second statement above does not seem to be borne out by Peiper's data. In light-adaptation the red had a higher value than the blue and green; and in dark-adaptation according to Peiper's data the red continues to have a higher stimulus value than do the blue and green. The shift to the short end of the spectrum has not been demonstrated in these data. If Peiper means by Purkinje phenomenon that after dark-adaptation the brightness value of red, in comparison to that of blue, is diminished, I grant that his data support his conclusion. But if by Purkinje phenomenon he means that after dark-adaptation red has a lesser stimulus value than have blue and green, then I must again refer the question to his data.

Peiper states that "If, for example, a given red and a given blue are selected and under illumination and light-adaptation the red appears brighter than the blue, then, upon lowered illumination and under dark-adaptation there will be a change in the opposing brightness-values under conditions so rigorous that now the red appears darker than the blue (or the blue brighter than the red)." This change is what I had considered to constitute the Purkinje phenomenon. However, by referring to the tabulation above, which gives the average values for the two subjects that Peiper tested under both dark- and light-adaptation, it will be seen that under dark-adaptation the relative brightness value given is

<sup>1</sup> Comments upon J. M. Smith's Work, "The Relative Brightness Values of Three Hues for New-born Infants." (See previous article in this journal).

less for blue than for red.

Peiper states, "That the relative brightness-value of colors to one another is most distinctly shifted, follows from the curves and figures which Smith<sup>2</sup> (p. 101) cites as counter-evidence from my work." This is undeniably true. Peiper has beyond question established that the relative brightness-value of the blue-green to the yellow-red ends of the spectrum do change from light- to dark-adaptation. Perhaps this fact may be interpreted to mean that the Purkinje phenomenon is present in prematures, and that with continued dark-adaptation the red and yellow values would drop further until they are less than the blue and green values.

Peiper, in his original report,<sup>3</sup> has himself suggested an approach to the question which if strictly carried out should clarify the issue. He states that his dark adaptation experiment "was designed to determine whether in this case the eye of the premature behaves like that of the adult; that is, whether the Purkinje phenomenon is already demonstrable." The assumption here is that if premature and adult eyes under the condition of dark-adaptation react similarly, the Purkinje phenomenon must be present in the premature. If Peiper's graphs for the premature are placed in juxtaposition with those of the adult, their similarity can be compared. That for the light-adapted eye is striking. The following graphs, in which the dotted line represents the values for the adult and the solid line those for the premature in the five experiments, make possible the comparison. The last two graphs, which give the average values for the two infants, Elfrieda and Michel, indicate the results as a whole and do not show the expected similarity to the adult eye values. As brought out above, these graphs show that the higher values for the dark-adapted premature eye are for the red and yellow, not for the green and blue as the Purkinje phenomenon demands.

The difference between Peiper's and my investigations to which he calls attention is perhaps an instance of a fundamental German-American procedure difference. It seems part of the German inheritance to select a small group of subjects and exhaust the possibilities of the group; and equally characteristic of the American to take a large group and apply statistical controls. I should defend my use of a large number of infants, and of treating the statistical average rather than the real individual, by saying that such a treatment allows for individual variation. I do not expect every boy infant to act differently from every girl infant. The data on ages are inexact; some babies were undoubtedly slightly premature while others had been carried beyond term. We know nothing of the inheritance of the infants, whether any had intellectual or visual defects or talents. I depend upon the statistical averages and treatments of differences to iron out such individual variations, and to indicate whether or not the average girl infant differs from the boy infant.

With respect to the condition of adaptivity of the eye, Peiper is of course entirely correct in contending that my five-minute dark period did not achieve complete dark-adaptation. My purpose in the use of the short dark period was not to secure complete dark-adaptation, but (1) to insure the same state of adaptiv-

<sup>2</sup>Smith, Josephine M.: The Relative Brightness Values of Three Hues for Newborn Infants. *Studies in Infant Behavior* III. (In) Wenger, M. A., Smith, Josephine, Hazard, Charles, and Irwin, Orvis C., Univ. of Iowa Stud., Stud. in Child Welfare, 1936, 12. Pp. 207 (p. 91-140).

<sup>3</sup>Peiper, Albrecht: Über die Helligkeits- und Farberfindungen der Fröngelburten. *Arch. f. Kinderheil.* 1927, 80, 1-20.



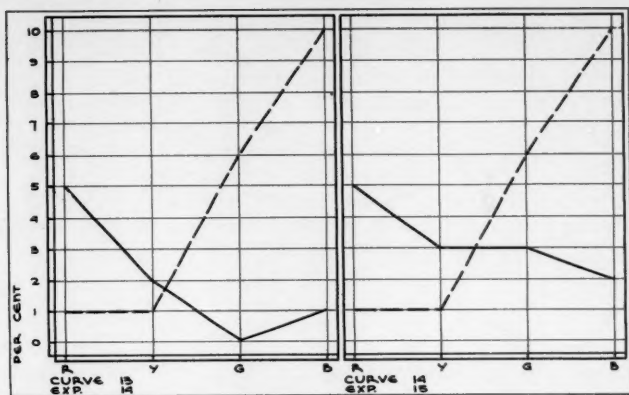


Figure 1

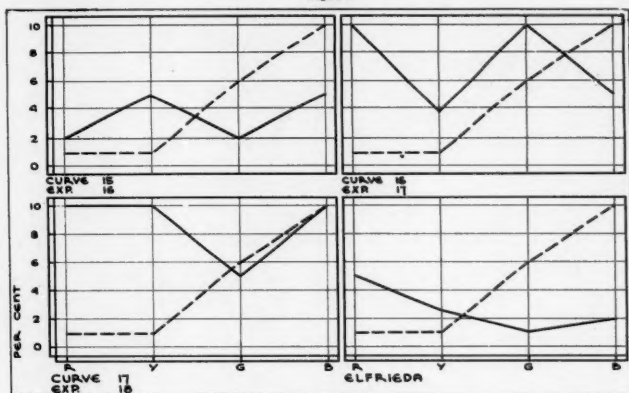


Figure 2

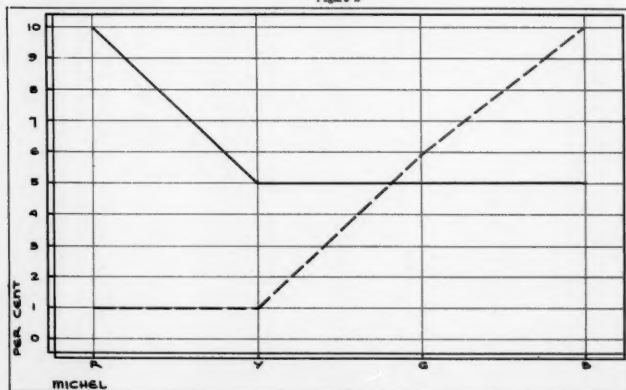


Figure 3

ity in all subjects and (2) to have it for use as a control (non-light-stimulating) period. Of course, after 20 seconds of light stimulation, the subjects' eyes were light-adapted, as the eyes of Peiper's infants must also have been after the first 20 seconds of his working period.

Peiper and I both sought in our studies to answer the question, Does the newborn infant possess hue-sensitivity? Also we both recognized the importance of the fact that the relative brightnesses of hues is not the same for color-seeing and for color-blind persons, a fact too often overlooked in color work. Therefore, Peiper's question became, "Do the relative brightness values of hues for the infant change after dark- and after light-adaptation?" and my question became, "What are the relative brightness values of hues for the infant under constant (light-adapted) conditions?" Peiper's criterion was the eliciting of the neck-reflex, and mine the inhibition of activity. So far our paths are similar.

However, the results of the two experiments are not alike. Peiper finds that red and yellow are less bright to the premature after dark- than after light-adaptation, and interprets this to indicate the presence of the Purkinje phenomenon.<sup>4</sup> My study found that blue and green inhibited activity (using activity in darkness as the comparison) 50 or almost 50 per cent, while red inhibited activity less than 25 per cent. Moreover, a sex difference was found. For the girl infants the percentages of inhibition exerted by blue, green, and red illumination were respectively 61, 42, and 47. This seems to indicate that the girls were stimulated by the blue, green and red lights; or that they probably possess color vision. But for the boys the percentages of inhibition exerted by blue, green, and red illumination were respectively 44, 22, and 6. There was not a statistically reliable difference between activity under red light and in darkness, indicating that the boys were not affected by the red. Apparently they do respond to blue. These facts lead to the tentative conclusion that the boys are at least partially color blind.

The intricate field of color vision has been approached by two different investigators in two different manners. The results of these experiments have led to contradictory conclusions. It is hoped that further research may lead to interpretations which will encompass both types of endeavor.

<sup>4</sup> This is the point of disagreement discussed above. Does the fact that red and yellow are duller after dark- than after light-adaptation demonstrate the presence of the Purkinje, or is it necessary that under dark-adaptation yellow and red be duller than blue and green?

## FREQUENCY OF CHOICE OF PLAY MATERIALS BY PRE-SCHOOL CHILDREN

MARION SILL McDOWELL<sup>1</sup>

There is considerable need for more information than is now available on the suitability of various toys and other play materials to the requirements of children of pre-school age. It is recognized that the child of this age group is forming habits of thinking and acting which will remain with him for a lifetime, and that his play, which is his chief daily activity, should therefore be directed well.

Various requisites of play materials are generally regarded as desirable, namely; developing large and small muscles in the child, training him in the recognition of color, form, and size, giving him certain manual skills, stimulating his imagination, and developing in him a sense of order. Although these objectives are accepted by most persons in the field, little actual information has been accumulated about the suitability of the different types of play materials on the market to the needs mentioned, and few data have been collected on the child's own likes and dislikes of these materials, if he is given freedom of choice in selecting the objects with which he plays.

The investigation described in this paper was undertaken in order to find out the interests of two and three-year old boys and girls enrolled in the Nursery School at The Pennsylvania State College, in the play materials at their disposal during spontaneous play periods at the school, this being the first in a series of studies carried on by the author and co-workers on problems closely related to the topic under discussion. Alice S. Stratton, Graduate Assistant in the Nursery School, is especially deserving of mention for her cooperation in carrying out this study and in collecting the data presented herewith.

### Play Materials

The play materials used in this study were the following: (1) doll corner; (2) dolls; (3) picture books; (4) clay; (5) paints; (6) blackboard; (7) beads; (8) large blocks; (9) medium blocks; (10) small blocks; (11) dishes; (12) flower tile; (13) concentric figures; (14) nest of eggs; (15) nest of dolls; (16) nest of rings; (17) nest of trays; (18) puzzles; (19) pyramid; (20) wooden animals; (21) ball; (22) pull toy; (23) cars; (24) trains; (25) truck; (26) wagon; (27) wheel barrow; (28) large pegboard; (29) small pegboard; (30) hammer toy; (31) seesaw; and (32) slide.

The doll corner included a tea table, a set of dishes, several dolls, doll clothes, a doll bed and bed clothes, a doll carriage, and a rocking chair.

### Subjects

The subjects used in the study were twenty children between 24 and 48 months, nine being boys and eleven girls. All of the children were from families of about the same income level, nine boys and eight girls being from professors' families, two girls from merchants' families, and one girl from a minister's

<sup>1</sup> From the Pennsylvania State College. The author wishes to acknowledge and express her appreciation to Dr. Pauline Berry Mack for the reading and criticism of the manuscript and assistance in mathematical treatment.

family.

Before beginning the study, the subjects were tested on the Merrill-Palmer intelligence scale to compare their mental ages (according to this method of testing) with their respective chronological ages. It was found that the mental ages of the children ranged from 29 to 61 months, eighteen children having mental ages higher than their chronological ages, one child having a mental age and a chronological age the same, and one being slightly lower in mental than in chronological age.

The study was conducted while the children were given about one hour of spontaneous indoor play each day during the school year. Records were taken of each child's activities during fifteen observation hours, these being interspersed throughout the duration of the study. One person served as observer for one child throughout one observation period.

Observations were made on the following points:

- (1) frequency of choice of materials;
- (2) attention span;
- (3) use of materials;

#### Observers

The observers were senior or graduate women students in Home Economics at The Pennsylvania State College, who had taken or were taking the Nursery School practice course. These persons were trained for the work by observing and recording the activities of children whom the author was simultaneously observing. This training was continued with each student until she was capable of turning in records closely corresponding with those of the author.

#### Directions for Observers

The directions given below were followed by each observer assisting in the study:

Remain sufficiently close to the child to be able to hear his language.

If a child gets into a situation, such as requiring help, such help should be given. Offer no help, however, unless such a situation arises.

If an unavoidable interruption occurs while an observation is in progress -- such as, toileting, washing hands, or undergoing a health examination -- record the number of minutes consumed during such interruptions, and increase the observation time by a like amount. The reason for all interruptions should be noted.

If a child under observation asks to have a story read to him, do so; but deduct the time from the observation period as mentioned above, such an activity not being regarded as child activity. If a child looks at a book alone, however, the time thus spent should be included in the record.

If a child asks to have music played, tell him that this will be provided later in the day. No music shall be played, however, until all observations for the day are completed.

If the observer is obliged to direct some social situation, this should be indicated on the record sheet. If any interference is given to a child under observation, this should likewise be noted. As much information concerning situations of this kind should be entered in the record as time permits.

No activity should be interrupted until it is voluntarily completed by the child.

If a child plays with an individual article from the doll corner without

regard for other articles in the corner, this should be listed under the individual item. If he uses two or more articles from the doll corner at one time, this should be entered as "doll corner".

#### Recording Sheet

The following Recording Sheet was used, explanations being given here for the type of record desired under each separate item.

Toy or Material. - Give name of toy or other play material selected by the child stating which specific article was used so that one article, such as a puzzle, or a set of blocks, may be distinguished from other articles of the same name.

Time. - Record the time when the activity was begun and ended.

Manipulations. - Record whether or not the play material was handled constructively, or with no idea of using it properly.

Uses. - Record the use made of the material, such as building a "tower" with blocks. If a puzzle was used, record what proportion of the pieces was used, and at what point the child considered the puzzle completed. Make similar records about other materials.

Return. - Check here if child returned material without the suggestion of an adult, at the end of his play with it.

Not Returned. - Check here if the material was not returned to its place.

Language. - As far as possible, quote the language of a child, whenever this has a bearing on his play activities. If he talks to other children, note the ones to whom he talks.

Imitation. - If a child follows a suggestion made by another child, or if he imitates another child note should be made of this.

#### Results Observed

In general approximately the same result was obtained when a child's interest in a certain toy or other play material was calculated from the attention span (the over-all time during which a child was engaged with the material at any one time) and when it was determined from the frequency with which this play material was chosen. For purposes of the present study, the frequency of choice is used as an index for estimating the popularity of a toy, a critical comparison of the attention span and the frequency of choice of the same toy by the same child being reserved for a future paper.

The comparative frequency of choice of the various play materials by boys and girls of the two age groups is shown graphically in Figure 1. On the right of the figure, the actual frequencies are used without regard for percentage of the total. On the left of the figure the frequencies are re-graphed on the basis of the percentage of the total cases in which a certain play material was selected. In both parts of the figure, the total choices, and the choices by boys and by girls of the three-year and the two-year groups are given. It will be noted from this figure that the differences between the play material choices made by the two sexes within the ages studied are considerably less than is usually supposed, there being no significant differences in the case of most of the play materials.

In Table 1 the play materials are grouped according to the type of activities involved in their use, some of them being similar in many respects. The follow-

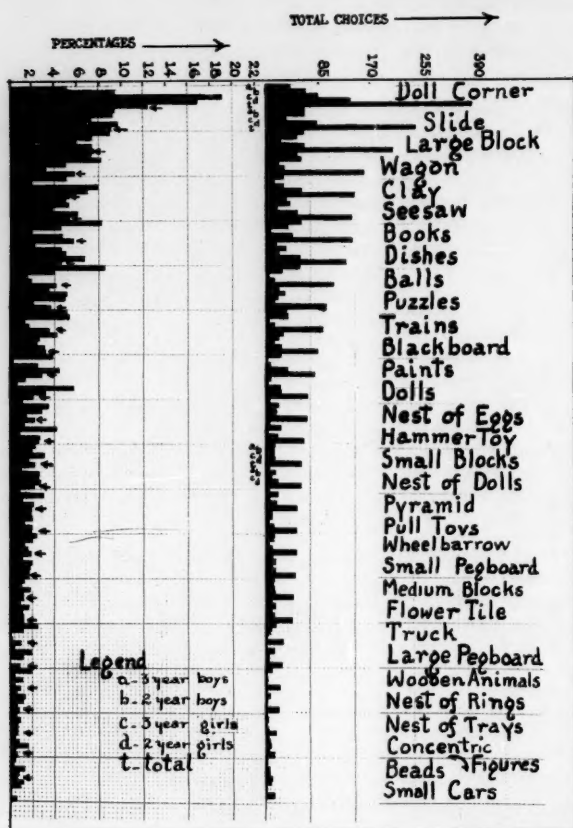


Figure 1. (Right) Actual frequencies of choice, based on a total of 2659 choices, including 665 choices for three-year old boys, 693 for two-year old boys, 440 for three-year old girls, and 841 for two-year old girls.

Figure 1. (Left) Percentage of the total cases in which a toy was selected by the total number of children, and by the specific group in question.

In both parts of the figure, the choices are given in the following order: (a) three-year old boys; (b) two-year old boys; (c) three-year old girls; (d) two-year old girls; and (t) total for each toy studied. In the left part of the figure, an arrow points to the total percentage choices.



ing groups were employed:

Materials used in constructing other objects.

(blocks, trains, wagon, wheelbarrow)

Materials involving manipulative skill of small muscles.

(puzzles, nests, pegs, concentric figures, pyramid, etc.)

Toys used in playing house.

(doll corner, dolls, dishes)

Materials requiring considerable physical activity.

(slide, seesaw, and large balls)

Materials used in creative design.

(paints, clay, etc.)

Picture Books

Materials requiring only a small amount of physical activity.

(pull toys, truck, and cars)

TABLE 1

Popularity of Groups of Toys as Indicated by Frequency of Choice

(Percentage of the total choices within each designated class of children)

Toy Group	3-Yr. Old Boys	2-Yr. Old Boys	3-Yr. Old Girls	2-Yr. Old Girls	Boys Com- bined	Girls Com- bined	3-Yr. Olds Com- bined	2-Yr. Olds Com- bined	Total
Materials Used in Constructing Other Objects (Blocks, etc.)	24.9%	22.5%	15.4%	15.2%	23.7%	15.3%	20.1%	18.8%	22.0%
Materials In- volving Manipu- lative Skill of Small Muscles	16.5	29.4	27.9	18.5	22.9	23.2	22.2	23.9	20.0
Toys Used in Playing House	9.6	14.4	29.7	25.0	12.1	25.6	19.8	20.1	18.3
Materials Re- quiring Con- siderable Physi- cal Activity	22.1	18.4	12.9	13.2	20.1	12.8	15.8	15.7	16.5
Materials Used in Creative Design	12.1	4.8	12.7	15.4	9.4	14.0	9.9	10.3	11.4
Picture Books	8.2	4.5	2.0	5.6	6.4	4.1	4.7	5.1	5.4
Materials Re- quiring Small Amount of Physi- cal Activity	5.5	4.3	1.3	2.6	4.8	2.0	3.2	3.0	3.8

A study of this table will show that, for all children of this age group, materials used in constructing other objects rank first, those requiring manipulative skill of small muscles and those used in playing house jointly coming second, those requiring considerable physical activity ranking third, those used in creative design fourth, picture books fifth, and those requiring only a small amount of physical activity last.

With regard to the most popular type of play material -- that used to build other objects -- this type of material was slightly more popular with girls than with boys, although it was chosen with equal frequency by three-year old and by

two-year old children.

Interest in such toys as puzzles, nests, concentric patterns, and other similar articles which call for manipulative skill in handling was displayed to the same degree by girls and boys, and by the children of both of the ages included in the study.

Although there was no difference in the popularity of articles needed for playing house between three- and two-year old children, there was found to be a significantly greater preference for these materials by girls than by boys. This difference was found to be less for two-year old than for three-year old children.

Girls showed a slight tendency toward a greater interest in materials needed for drawing, modeling, and other activities of this sort than boys, and two-year old boys were behind three-year old boys in this interest.

Picture books, although constituting but 5.4 per cent of the total choices of all of the children, appeared to be enjoyed slightly more by boys than by girls. The number of choices involved in this particular case, however, was too small to establish a significant difference.

Pull toys, and other similar articles requiring but a small amount of physical activity, were not especially popular with the children of two and three years, probably because these were of greater interest to the younger children of this study, and those still younger than the ones included here.

The use made by each of the materials chosen by the children was noted in the record, and this will be presented in a later paper. In passing a few examples of interest in this connection seem worthy of mention. In playing with a nest of eggs, a boy of 27 months was observed to put the nest together twenty-two times in fifty-five minutes, each time (until the last), making some such mistake as leaving out some of the pieces. He was heard to say, "too bad, too bad" when an error was made, only to start over again familiarizing himself with form and color until the nest was mastered.

In using clay, children were frequently seen to model various well-known articles, particularly animals, later naming the objects created and playing games in which these objects were featured. In some cases, a child's chief interest seemed to be to finish the operations necessary in assembling the puzzles or nests left incompleated by other children. In other cases, certain children seemed to make their chief activity the putting away of toys not put away by other children.

The use of the same toy by children of different ages is of particular interest in this connection. A child of two is likely to play with dishes by crowding onto a table all of the dishes possible, with no apparent order or purpose. At three, he is likely to set the table in an orderly manner, playing at having a meal. Another example showing the use of toys progressively at different age levels is that of the doll buggy. A boy of two is likely to push an empty doll carriage around more or less aimlessly for something on wheels to push. At three, the same child will place a doll in the carriage and play that he is taking a baby to the doctor for treatment.

This is a report of a study in which the interests in play materials of boys and girls of pre-school age were investigated. A table of the preferences shown by the children in 32 toys, coming under 7 different classes, is given. This should be helpful to parents and others wishing to choose toys which children of two and three years of age would enjoy.

## CHANGES IN BODY PROPORTIONS DURING INFANCY AND THE PRESCHOOL YEARS:

### II. WIDTH OF HIPS IN RELATION TO SHOULDER WIDTH, CHEST WIDTH, STEM LENGTH, AND LEG LENGTH

VIRGINIA B. KNOTT AND HOWARD V. MEREDITH<sup>1</sup>

#### INTRODUCTION

"It has long been recognized that the development of the vertebrate embryo tends, in general, to proceed from the cephalic to the caudal pole of the body-stem, from the proximal to the distal segments of the extremities, and, possibly, from the dorsal to the ventral surfaces or regions of the body." (9, p. 267) More recently, it has been found that this general principle of developmental direction has numerous applications beyond the embryonic period. Schultz (10, 11), in particular, has sought anthropometric evidence of expression of the principle in the fetal growth of man and other primates.

Illustrative examples of findings for the fetal period (the period extending from the third prenatal month to the beginning of postnatal life) are available on human material in such major investigations into physical growth as those by Schultz (10, 11), Scammon and Calkins (9), and Boyd (2). Boyd made a critical evaluation and synthesis of research relating to the growth of the human body in surface area. She found the total area of the surface of the body at the beginning of the fetal period to be apportioned as follows: 33 per cent to the head region, 36 per cent to the trunk region, 13 per cent to the upper extremities, and 18 per cent to the lower extremities. By the close of fetal life, the total area was distributed with 21 per cent to the head, 32 per cent to the trunk, 17 per cent to the upper extremities, and 30 per cent to the lower extremities. The fetal growth period was thus found to be characterized by an increase in the surface area of the trunk relative to the head and by an increase in the surface area of the legs relative to the head, the arms, and the trunk. Boyd concluded that "This general pattern of the age progression in proportionate parts...definitely demonstrates the existence of a fundamental increasing gradient of growth in the fetal period from the head downward...and indicates its probable extension into the postnatal period." (2, p. 123)

Scammon and Calkins (9) studied human growth during the fetal period with respect to seventy-one external dimensions of the body. Their subjects were upwards of 400 well-preserved, Caucasian fetuses. Selected findings from these authors which show marked changes in body proportions between the beginning and the close of the fetal period are: (1) the length of the head and neck -- vertex to suprasternal notch -- decreases from 35.6 per cent of total length at three fetal months to 28.4 per cent of total length at ten fetal months, (2) stem length -- vertex to rump -- decreases from 73 per cent of total length at three fetal months to 67 per cent of total length at ten months, (3) length of the upper limb -- acromion to tip of middle finger -- decreases from 103.8 per cent of the lower limb length -- trochanter to heel -- at three months to 94.2

<sup>1</sup>From Iowa Child Welfare Research Station, State University of Iowa, Iowa City, Iowa.

per cent of lower limb length at ten months, (4) breadth of the pelvic girdle -- bi-crystal diameter -- increases from 56.6 per cent of the breadth of the shoulder girdle -- bi-acromial diameter -- at three months to 70.0 per cent of the shoulder girdle at ten months, (5) lower limb length increases from 45.3 per cent of stem length at three months to 62.1 per cent of stem length at ten months, and (6) lower limb length increases from 110 per cent of trunk length -- supra-sternal notch to symphysis pubis -- at three months to 132 per cent of trunk length at ten months. Alternatively, Scammon and Calkins arrive at the same principle implied in their proportionate findings by analyzing the rate of growth for each individual dimension and showing that as this rate declines during the fetal period the decline "is more pronounced for the dimensions of the head and neck than for those of the trunk, and is greater for dimensions of the trunk than those of the pelvis and extremities." (9, p. 277)

Schultz (11) analyzed data for a large series of physical measurements taken on more than 600 human fetuses. Included among his findings are the following items: (1) stature in percentage of stem length increases from 132 at three fetal months to 148 at ten fetal months, (2) bi-trochanteric diameter of the hips in percentage of bi-acromial diameter of the shoulders increases from 68 at three fetal months to 84 at ten fetal months, (3) length of the forearm in percentage of length of the upper arm increases from 74 at three months to 79 at ten months, (4) length of the lower leg in percentage of length of the thigh increases from 69 at three months to 79 at ten months, and (5) total length of the upper extremity in percentage of total length of the lower extremity decreases from 117 at three months to 104 at ten months. These findings indicate that with advance in fetal growth the legs become longer in relation to the arms and to the body stem, the more distal segments of the upper and lower limbs (forearm and lower leg) become longer in relation to the proximal segments, and the trunk becomes relatively broader at its lower end. In another paper (10) Schultz has presented some additional findings showing that the growth of the trunk is at least partially explained "by a general rule of development, according to which the cephalic end of the body shows an initial acceleration as compared with the more caudal portions." (10, p. 150) This evidence consists of a study of age changes in the spinal column. The length of the different regions of the praesacral spine are expressed in percentage of the total length of the praesacral spine. It is found that in the human fetus the cervical region comprises 26 per cent of the total, the thoracic region 49 per cent, and the lumbar region 25 per cent, while in the adult the percentages are 22 cervical, 46 thoracic, and 32 lumbar. The relative decrease in the cervical and thoracic regions is interpreted as an expression of the embryological principle of an initially retarded development of the caudal region of the body which, subsequently, implies a more intense rate of growth in the lumbar or caudal region of the praesacral spine.

To what extent does physical growth during infancy and the preschool years conform to this general pattern for the embryo and fetus? More specifically, to what extent does the principle of developmental direction extend into postnatal life and characterize physical growth between birth and six years of age? Scattered findings are available for the stem/stature index, the hip/stature index, the hip/stem index, the arm/leg or intermembral index, the chest/hip index, and the hip/shoulder index. Additional information on the question is furnished by Boyd's (2) monograph on the surface area of the body, by the investigation to be reported in this paper, and, indirectly, by studies giving means at frequent age

intervals for separate dimensions of the head, trunk, and extremities.

The stem/stature index has been studied by Stockton-Hough (12), Bayley and Davis (1), Wallis (13), and Hejinian and Hatt (7). Stockton-Hough found the length of the body stem to average 65.2 per cent of the total length for 330 newborn white males and 65.8 per cent of total length for 382 newborn white females. Bayley and Davis took serial stem and stature measurements on thirty-one male infants and thirty female infants. They obtained an index trend for both sexes combined which increased from 65.1 at one month to 65.3 at three months, fluctuated around 65.3 between three and seven months, and then decreased to 56.8 at three years. Hejinian and Hatt found means for the stem/stature index, based on thirty to sixty cases for each sex at successive six-month age intervals, to decrease from 61.0 at two years to 56.7 at five years. Wallis obtained mean stem/stature indices at annual intervals from two to six years of age. She found stem length to approximate 60.5 per cent of total length at two years and 55.7 per cent of total length at six years. Since these studies may be summarized as indicating that the stem/stature index decreases from 65.5 at birth through 60.5 at two years to 55.7 at six years, it follows that, in general, the legs grow at a faster rate than the body stem during the first six years of postnatal life.

The trend for the hip/stature index during infancy and the preschool years has been partially studied by Bayley and Davis (1), Lucas and Pryor (8), and Davenport (5). Bayley and Davis found bi-trochanteric diameter of the hips to equal 19.9 per cent of total length at one month, 21.6 per cent at seven months, and 18.8 per cent at three years. Lucas and Pryor found bi-cristal diameter of the hips in percentage of stature to decrease from a mean of approximately 17.4 at six months to a mean of 16.0 at six years. Davenport obtained means for hip/stature index of 16.1 at six years of age for both males and females. His subjects were Brooklyn orphan asylum children of Nordic stock, and the hip measurement employed was bi-cristal diameter. The findings from these studies suggest that hip width increases in relation to stature during the early months of postnatal life, and from this time to six years of age it shows a tendency to relative decrease.

For elucidation of the principle of developmental direction it is obviously less meaningful to relate hip width to stature than to relate it to the components of stature which lie, in the main, either above (stem length) or below (leg length) the level of the hips. Means for hip/stem index are included in the previously cited reference by Bayley and Davis. These authors found bi-trochanteric diameter of the hips to equal 30.6 per cent of the stem length at one month, 33.2 per cent at six months, 32.6 per cent at nine months, and to remain approximately constant from nine months until two years of age, when it stood at 32.7 per cent. Viewing these findings in relation to those given above for the hip/stature index, the following inference may be tentatively drawn: hip width increases both in relation to stem length and leg length during the early months of postnatal life, while from this time until at least two years of age it remains relatively constant in relation to stem length and decreases in relation to leg length. This inference has been tested in the present investigation.

Wallis (13, 14) made two studies in which she obtained the arm/leg, or intermembral, index. In both instances the index was found to fall steadily from two to six years of age. The rate of decrease lessened with age and amounted to roughly 10 index points for the four-year period. It thus appears that during the preschool years leg length increases faster than arm length to the extent

that in the four-year interval arm length decreases by 10 per cent in its relation to leg length.

The chest/hip index has been studied by Freeman (6) on New York children. He obtained mean indices for width of chest in percentage of hip width of 108.2 for 160 males at one day after birth and 109.1 for 149 females at the same age. Additional cases for each sex between one and six years ranged from 18 to 53 for successive one-year age groupings. The mean index declined, for males, from 113.1 at one year to 98.2 at six years and, for females, from 111.5 to 94.9 over the same age span. Unfortunately, Freeman did not state at what level the transverse diameter of the thorax was measured, or what landmarks were used in taking hip width.

Davenport (5) and Wallis (13) have reported findings for the hip/shoulder index. Davenport measured intercrystal and bi-acromial diameters on five newborn infants, eighteen infants ranging in age between two and 107 postnatal days, and a larger group of males aged six years. He found the index to increase from 75 at birth to 78 at about six postnatal weeks and to decrease to 70.2 at six years. Wallis took the same hip and shoulder measurements on a small sampling of children two to six years of age. She found the width of the hips to approximate 70 per cent of shoulder width at two years and 72 per cent of shoulder width at six years. It will be noted that Wallis' trend from two to six years harmonizes with the principle of developmental direction but that Davenport's figures indicate a contradictory trend after about six postnatal weeks. Further study of this index has been made in the present investigation.

Finally, it is relevant to mention Boyd's (2) findings for surface area during infancy and the preschool years. She reports that the surface area of the head decreases from 20.8 per cent of the total surface area of the body at birth to 12.6 per cent of the total area at six years of age. In contrast, the surface area of the upper extremities increases from 16.8 per cent of the total at birth to 19.6 per cent at six years, and a still greater increase for the lower extremities -- from 30.5 per cent of the total at birth to 34.4 per cent at six years. These findings clearly harmonize with the principle of developmental direction.

#### PURPOSE

The present investigation was undertaken to ascertain the developmental trend for certain human proportions during the age period from birth to six postnatal years. Following preliminary study of the literature, it was decided that bi-iliac diameter of the hips be used as a focal dimension and that this be related to two major length measurements and two major breadth measurements. The four indices selected for analysis were:

Hip/Stem Index, or bi-iliac diameter in percentage of vertex-rump length

Hip/Leg Index, or bi-iliac diameter in percentage of vertex-heel length minus vertex-rump length

Hip/Shoulder Index, or bi-iliac diameter in percentage of bi-deltoid diameter

Hip/Chest Index, or bi-iliac diameter in percentage of transverse diameter of the thorax at the level of the xiphisternal junction



What statement can be formulated as to the probable course of the mean curve for each of these indices during infancy and the preschool years? Inference from the studies discussed above and from other research on physical growth during early postnatal life yields the following hypotheses:

1. The hip/stem index increases during the early months of postnatal life and from this age to six years either remains constant or shows a slight increase.
2. The hip/leg index increases during the early months of postnatal life and then decreases markedly to six years of age. Leg length thus grows faster than hip width over more than five-sixths of the age span under study.
3. The hip/shoulder and hip/chest indices register an increase between birth and six years. The increase is probably more marked during the early months of infancy than during the preschool years.

It is the purpose of this study to test these hypotheses and to determine the amount of increase or decrease from age to age.

#### DATA

The basic data are approximately 3,500 measurements each for hip width, chest width, stem length, and stature, and 2,800 measurements for shoulder width. These data were accumulated by the anthropometric staff of the Iowa Child Welfare Research Station during the years 1929 to 1936. Observations for hip width, along with one or more of the other four dimensions, were available for fifty males and fifty females aged twenty-four to forty-eight postnatal hours and for 557 males and 448 females between the ages of one month, fifteen days and six years, two months, fourteen days. The former group consisted of full-term white infants of American parentage measured at the University hospital, Iowa City. Their records carried values for hip width, stem length, and stature. The latter group was measured at the University of Iowa infant laboratory, preschool laboratories, and elementary school. Many of these children had repeated measurements over a period of two years or more.

With respect to the larger group of subjects, care was taken to see that in no instance was the record marked as applying to an individual of Negroid, Mongoloid, Jewish, or southeast European stock, or to an individual who was physically pathological. About 50 per cent of the records gave detailed information concerning the birthplace of parents and grandparents, and occupational status of the father.

Analysis of the birthplace items showed that both parents of 92 per cent of the children and all four grandparents of 55 per cent of the children were born in the United States. Tabulation of the occupational status data revealed that 31 per cent of the fathers were of the professional class, 24 per cent were managers, salesmen, or business proprietors, 41 per cent were skilled trade employees, clerks, or carriers, and 4 per cent were day laborers.

It is apparent, then, that the sample employed is homogeneous in regard to geographical location (Iowa City children) and not greatly diverse as to ethnic stock (American-born children of northwest European ancestry). With reference to socio-economic level, the sample is predominantly composed of the professional and managerial classes.

The measurements on both groups of subjects were taken according to the following technique:

**Hip:** Bi-iliac diameter of the hip was measured with the large, straight-arm, sliding calipers (Hrdlička compass). Sufficient pressure was used to approximate a bony measurement of the maximum width between the crests of the ilia.

**Stem:** The technique varied according to the age of the subject. Below two years of age, the stem (vertex-rump) length was taken on the Baldwin Measuring Board for Infants. From two years on, stem length was obtained with the subject in an erect sitting position.

**Leg:** Leg length was not directly measured, but was derived as stature minus stem length. As in the case of stem length, stature was determined in the recumbent position on subjects below two years of age and in the erect standing position (with heels, buttock, upper part of back, and occipital region of head in contact with the vertical measuring scale) on subjects older than two years.

**Shoulder:** Bi-deltoid diameter of the shoulders was taken with the large, straight-arm, sliding calipers. Firm contact was used. (Bi-deltoid diameter is employed in the present study not because it is preferred to bi-acromial diameter but because bi-acromial diameter was not available for subjects younger than two years of age.)

**Chest:** Transverse diameter of the thorax was taken with the Hrdlička compass. The measurement was recorded as the mid-respiration value at the level of the xiphisternal junction.

#### HIP/STEM INDEX

Bi-iliac diameter in percentage of stem length was calculated for 2,009 paired measurements on males and 1,596 paired measurements on females. The resulting index values were distributed into nineteen age groupings for each sex. Table 1 lists the number of observations within each age grouping and shows the analysis made for each of the thirty-eight series of index values. Curves drawn to the successive index means for males and females are given in Figure 1. Examination of this tabular and graphic material reveals the following findings:

1. The amount of change in the hip/stem index between birth and six years of age is not great. At birth, bi-iliac diameter in percentage of vertex-rump length averages approximately 24.5. By six years of age the mean index has risen to slightly more than 29 per cent. The amount of increase in the mean index for the six-year age span stands at 4.5 per cent for males and 5.1 per cent for females.
2. The only marked change in the proportionate relation between hip width and stem length occurs during the period from birth to three months of age. For males there is an increase in mean index from 24.7 per cent at birth to 28.1 per cent at three months. The corresponding increase for females is from 24.4 per cent to 27.9 per cent.
3. There is a moderate rise in the hip/stem index between three and six months of age. Combining this rise with the more marked rise from birth to three months, it appears that roughly 87 per cent of the increase in the index from birth to six years is made between birth and six months.
4. The hip/stem index changes but little between six months and six years of age. During the interval from six months to three years the mean trend shows first a slight decline and then a compensating rise. This retardation and acceleration, however, is confined within the narrow zone of 28 to 29 per cent. From three to six years the mean indices remain relatively constant, falling between 28.9 and 29.2 for males and, for females, between 29.2 and 29.7.
5. There is no marked sex difference apparent in the relation of hip width to stem length. On the whole, the males tend to show a lower index than the females and at four years, six months the difference was found to be statistically significant. Since Boynton (3) has shown that males slightly exceed females in mean bi-iliac diameter during infancy and the preschool years, this lower index

implies that males surpass females by a greater margin in the stem component of this index than they do in the hip component.

TABLE 1  
Bi-iliac Diameter of Hips in Percentage of Vertex-  
Rump Length or Sitting Height\*

Mean Age		Cases	Mean	Standard Error of Mean	Stand- ard Dev- iation	Range
Year	Month					
Males						
	0**	50	24.7	.20	1.41	20.4 to 28.2
	3	65	28.1	.22	1.73	23.7 to 33.4
	6	109	28.8	.19	2.03	24.1 to 34.4
	9	136	28.6	.15	1.75	24.6 to 33.3
1	0	152	28.5	.13	1.60	25.3 to 33.0
1	3	141	28.3	.12	1.47	24.8 to 32.1
1	6	118	28.0	.12	1.29	25.0 to 31.2
1	9	103	28.1	.12	1.21	25.5 to 30.4
2	0	109	28.4	.14	1.41	25.3 to 31.8
2	3	101	28.4	.12	1.19	25.9 to 31.3
2	6	94	28.6	.13	1.24	25.6 to 31.5
2	9	97	28.6	.11	1.11	26.4 to 31.5
3	0	113	28.9	.12	1.32	25.2 to 31.5
3	6	106	29.0	.11	1.18	25.8 to 32.2
4	0	102	29.1	.12	1.18	25.9 to 31.7
4	6	100	29.0	.12	1.17	25.8 to 32.1
5	0	102	29.2	.12	1.23	25.5 to 32.1
5	6	110	29.2	.12	1.24	25.4 to 32.2
6	0	101	29.2	.11	1.12	25.6 to 32.3
Females						
	0**	50	24.4	.16	1.10	22.4 to 27.8
	3	51	27.9	.28	2.03	22.7 to 32.8
	6	106	28.7	.21	2.14	24.1 to 34.1
	9	117	28.6	.18	1.93	24.4 to 33.8
1	0	119	28.5	.16	1.77	24.7 to 33.1
1	3	108	28.3	.15	1.54	24.7 to 31.9
1	6	98	28.5	.13	1.29	25.5 to 32.1
1	9	87	28.4	.15	1.36	25.4 to 31.3
2	0	74	28.4	.15	1.27	25.4 to 31.2
2	3	76	28.2	.13	1.12	25.6 to 31.3
2	6	68	28.7	.12	.99	26.3 to 32.0
2	9	66	28.8	.14	1.17	26.5 to 31.2
3	0	66	29.2	.13	1.09	26.8 to 31.5
3	6	75	29.4	.14	1.18	26.4 to 33.4
4	0	76	29.6	.16	1.37	26.8 to 33.8
4	6	84	29.7	.14	1.26	27.2 to 33.5
5	0	94	29.4	.12	1.18	26.8 to 33.7
5	6	93	29.3	.14	1.37	26.1 to 33.3
6	0	88	29.5	.14	1.30	27.1 to 33.4

\*The basic data were obtained from measurement of Iowa City males and females of northwest European descent.

\*\*The statistical constants at this age are derived from data for fifty infants of each sex measured two days following birth.

#### HIP/LEG INDEX

Results of the analysis for this index are given in Table 2. The procedure of age grouping was similar to that used above, the index values being derived from 2,009 paired measurements for males and 1,594 paired measurements for females. Figure 2 shows curves drawn to the mean values for males and females. Findings are:

1. The mean trend for hip/leg index is characterized by an initial abrupt rise from birth to three months. This rise is followed by a sweeping fall which is prolonged at a decreasing rate throughout the entire period from three months to six years of age.

2. The amount of change in the proportion of hip width to leg length during

the age span from birth to six years is approximately 11.5 per cent for both sexes. The maximum change, however, is almost double this amount. For males, the mean index stands at 57.3 at three months -- 21.1 per cent higher than its value at six years. For females, the decline from three to six years is from 56.7 to 36.1, or 20.6 per cent.

3. The abrupt rise in the index from birth to three months is accounted for by the fact that bi-iliac diameter is growing rapidly at this time. From a mean bi-iliac diameter of 7.9 cms. at birth, there is an increase of roughly 40 per cent for the next three months (to 11.2 cms.). The corresponding percentage increase for rump-heel length is around one-half this amount (from approximately 16.5 cms. at birth to 19.9 cms. at three months).

4. Subsequent to this initial spurt in hip width the legs lengthen rapidly in proportion to the widening of the pelvic girdle. By one year, three months the index approximates its birth value and by six years of age it has decreased

TABLE 2  
Bi-iliac Diameter of Hips in Percentage of  
Length of Lower Extremities\*

Mean Age		Cases	Mean	Standard Error of Mean	Stand- ard De- viation	Range	
Year	Month						
Males							
1	0**	50	48.0	.55	3.91	40.7 to 57.3	
	3	65	57.3	.75	6.02	45.2 to 71.7	
	6	109	55.5	.58	6.01	41.5 to 70.2	
	9	136	52.7	.38	4.44	43.4 to 63.0	
	1	152	49.9	.31	3.79	41.9 to 59.9	
	1	3	141	47.8	.27	3.15	40.6 to 57.6
	1	6	118	45.9	.23	2.47	39.8 to 52.4
	1	9	105	45.2	.26	2.62	39.7 to 52.4
	2	0	109	44.4	.25	2.56	39.0 to 50.5
	2	3	101	45.5	.22	2.18	38.5 to 49.5
	2	6	94	42.6	.20	1.95	35.3 to 47.3
	2	9	97	41.9	.20	2.00	37.5 to 46.4
2	0	113	41.5	.20	2.12	37.5 to 45.9	
	3	6	106	40.5	.18	1.86	36.1 to 45.2
	4	0	102	39.4	.18	1.83	35.6 to 44.2
	4	6	100	38.7	.18	1.85	35.0 to 42.9
	5	0	102	37.7	.18	1.84	33.5 to 41.9
	5	6	110	36.9	.17	1.74	32.5 to 41.2
	6	0	101	36.2	.16	1.66	32.7 to 40.4
	Females						
	1	0**	50	47.5	.49	3.46	41.0 to 55.1
		3	51	56.7	.99	7.06	41.8 to 70.1
		6	106	54.4	.47	4.89	43.9 to 67.4
		9	116	51.7	.41	4.46	43.6 to 64.0
1		0	119	49.6	.35	3.91	38.3 to 58.1
1		3	108	47.2	.33	3.38	39.1 to 54.2
1		6	98	46.1	.27	2.69	40.6 to 52.7
1		9	87	44.6	.28	2.64	39.1 to 51.7
2		0	74	43.6	.28	2.39	37.8 to 48.9
2		3	76	42.5	.24	2.06	38.4 to 47.2
2		6	68	42.2	.26	2.14	38.4 to 46.4
2		9	66	41.5	.27	2.21	37.7 to 46.1
3	0	66	41.0	.25	2.02	37.5 to 45.0	
	3	6	75	40.0	.21	1.95	35.3 to 44.4
	4	0	76	39.4	.24	2.06	35.3 to 44.7
	4	6	84	38.7	.22	2.01	34.8 to 43.7
	5	0	94	37.3	.19	1.98	32.8 to 42.1
	5	6	92	36.6	.20	1.87	31.5 to 41.2
	6	0	88	36.1	.19	1.79	31.8 to 41.9

\*Bi-iliac diameter was taken as a direct measurement and length of lower extremities derived as stature minus sitting height. The subjects were Iowa City males and females of northwest European descent.

\*\*The analyses at this age are based on data for fifty infants of each sex measured two days following birth.

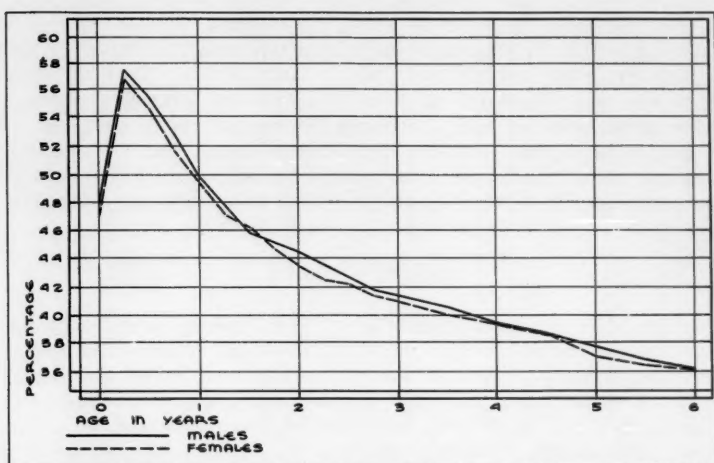


Figure 2. - Hip/Leg Index: Curves for Males and Females Drawn to the Series of Mean Values Given in Table 2.

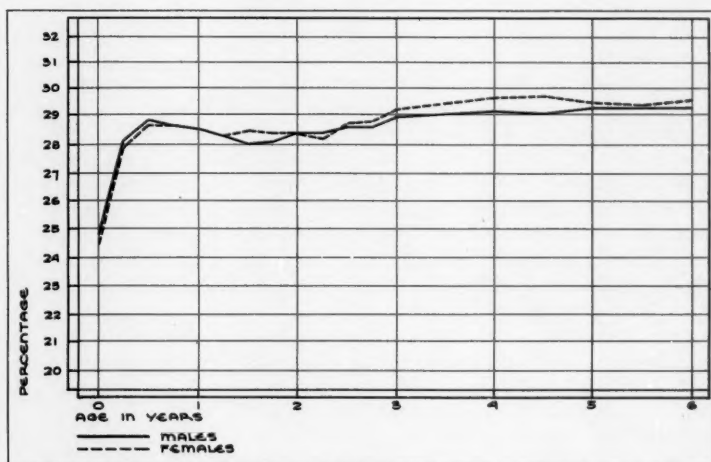


Figure 1. - Hip/Stem Index: Curves for Males and Females Drawn to the series of Mean Values Given in Table 1.

to more than 11 index points below this value. The decline is especially marked until about two years of age.

5. The curves for the two sexes follow each other closely. In the main, males tend to show a higher index than females, though the difference is not statistically significant except at two years, three months. There is little indication of the relatively wider hips and shorter legs which have been posited to characterize the adult female.

6. Between three months and six years of age the variability, as measured by the standard deviation and range, decreases for each successive age group. This steady decline in absolute variation is perhaps to be explained, in part, on the basis of individual differences in the time of acceleration in the rate of growth for leg length and, in part, as a function of the increasing difference with age between the magnitude of hip width and the magnitude of leg length.

#### HIP/SHOULDER INDEX

The hip/shoulder index was obtained as bi-iliac diameter in percentage of bi-deltoid diameter. As previously pointed out, bi-deltoid diameter was used as the shoulder component of the index since measurement values for bi-acromial diameter were not available below two years of age. Indices were computed from 1,626 and 1,204 paired measurements for males and females, respectively. The reduction in the number of paired observations for this index is due to the fact that there were fewer records for bi-deltoid diameter toward the upper end of the age scale (bi-acromial diameter being the routine shoulder measurement made on the preschool children).

The procedure in analysis paralleled that described for the hip/stem index. Table 3 gives the results. Trends drawn to the series of means for each sex are presented in Figure 3. The irregularities in the female trend between three and six years of age are probably accounted for in that the number of observations within each age grouping for these years is less than fifty.

In order to obtain an estimate of the percentage relation of bi-iliac diameter to bi-deltoid diameter at birth, hip/shoulder ratios were calculated from mean values for each dimension given by Cates and Goodwin (4). These means were based on upwards of 300 twelve-day-old infants of each sex. The ratios obtained are 61.5 for males and 62.2 for females.

Table 3, supplemented by Figure 3 and by the approximate birth values for the index, yields the following findings:

1. There is a sharp rise in hip/shoulder index between birth and three months of age. The mean index at birth is estimated at 61.5 for males and 62.2 for females. The mean index at three months is found to be 66.8 for males and 69.2 for females. It follows from these figures that the bi-iliac diameter of the hips in its percentage relation to bi-deltoid diameter of the shoulders increases by about 7 per cent during the first three postnatal months.

2. From three months to around one year of age the mean hip/shoulder index registers a moderate decrease. This decrease extends to 67.4 per cent at one year for females and to 67.1 per cent at one year, three months for males. It thus amounts to approximately 1.75 per cent for each sex.

3. There is a gradual acceleration in the percentage relation of bi-iliac diameter to bi-deltoid diameter from the early part of the second year to about four and one-half years of age. For males, this acceleration raises the mean

index from 67.1 at one year, three months to 71.1 at four years, six months. The ascent for females, while less regular, likewise appears to give an increase in mean index in the vicinity of 4 per cent.

4. Between four and one-half years and six years of age the hip/shoulder index appears to remain roughly constant. In view of the paucity of observations on which means for this segment of the age span are based, the inconclusiveness of this formulation should not be overlooked. The obtained mean indices at four years, six months to six years will be seen to show minor fluctuation around 71.1 for males and to decrease from 72.2 to 71.2 for females.

5. Inspection of the hip/shoulder index trends with reference to sex differences reveals the slight (though not statistically significant) tendency for males to have wider shoulders relative to their hip width than females.

TABLE 3

Bi-iliac Diameter of Hips in Percentage of Bi-deltoid Diameter of Shoulders\*

Mean Age		Cases	Mean	Standard Error of Mean	Standard Deviation	Range	
Year	Month						
Males							
1	3	65	68.8	.42	3.42	59.8 to 78.4	
	6	109	68.7	.42	4.39	60.1 to 78.5	
	9	136	67.9	.33	3.84	60.3 to 76.2	
	1	0	152	67.3	.32	4.01	58.0 to 78.3
	1	3	141	67.1	.27	3.24	60.4 to 77.2
	1	6	118	67.4	.29	3.19	61.3 to 75.8
	1	9	103	67.6	.30	3.05	60.5 to 75.4
	2	0	109	67.8	.29	3.01	60.1 to 74.8
	2	3	101	68.3	.29	2.94	61.2 to 75.2
	2	6	94	68.9	.22	3.15	60.9 to 75.2
	2	9	97	69.2	.31	3.06	63.4 to 76.5
	3	0	96	69.5	.31	3.02	62.6 to 76.9
3	6	86	70.1	.32	2.93	63.1 to 77.9	
4	0	71	70.7	.42	3.53	62.9 to 79.2	
4	6	54	71.1	.47	3.44	63.7 to 78.9	
5	0	39	71.1	.53	3.32	63.6 to 80.2	
5	6	31	71.2	.57	3.15	66.2 to 78.7	
6	0	24	70.8	.55	2.67	66.2 to 78.1	
Females							
1	3	51	69.2	.60	4.25	58.3 to 80.0	
	6	106	69.1	.40	4.09	60.7 to 80.2	
	9	117	68.3	.35	3.60	57.4 to 78.0	
	1	0	119	67.4	.34	3.76	57.8 to 74.9
	1	3	108	67.6	.34	3.50	60.0 to 75.5
	1	6	97	67.9	.30	2.95	61.0 to 76.5
	1	9	87	67.6	.31	2.89	61.3 to 75.1
	2	0	74	68.1	.34	2.96	62.2 to 75.6
	2	3	72	68.1	.33	2.82	61.9 to 74.6
	2	6	61	68.9	.32	2.62	63.0 to 75.5
	2	9	58	69.4	.44	3.32	62.3 to 76.5
	3	0	53	70.2	.37	2.71	64.8 to 76.7
3	6	46	70.9	.45	3.08	64.2 to 79.2	
4	0	31	71.1	.65	3.62	63.1 to 81.9	
4	6	38	72.2	.57	3.52	67.1 to 81.9	
5	0	32	71.8	.66	3.76	65.9 to 83.8	
5	6	20	71.1	.92	4.09	64.9 to 81.0	
6	0	34	71.2	.52	3.04	65.8 to 78.3	

\*The basic data are measurement values for Iowa City males and females of northwest European descent.

#### HIP/CHEST INDEX

The number of basic measurements available for computation of this index approximated the numbers for the hip/stem and hip/leg indices. Specifically, there was a total of 3,501 paired measurements, 1,960 for males and 1,541 for



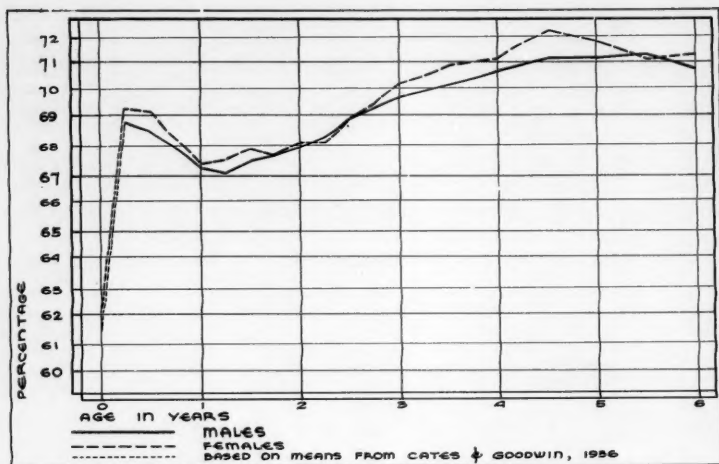


Figure 3. - Hip/Shoulder Index: Curves for Males and Females Drawn to the Series of Mean Values Given in Table 3 and to Supplementary Data from Cates and Goodwin (4).

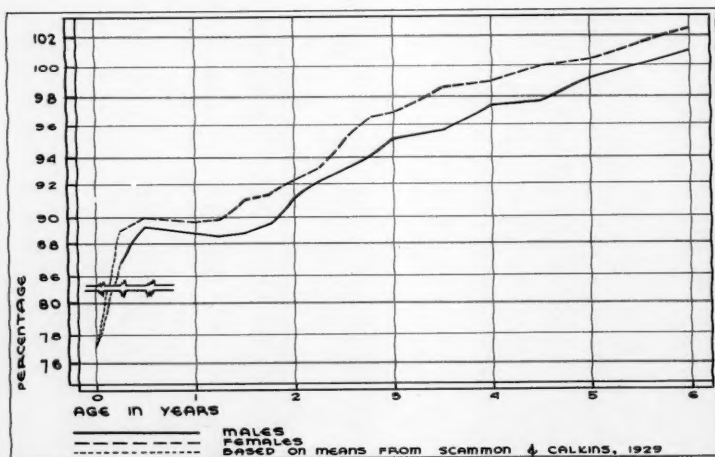


Figure 4. - Hip/Chest Index: Curves for Males and Females Drawn to the Series of Mean Values Given in Table 4 and to Supplementary Data from Scammon and Calkins (6).

females. The index values were distributed and analyzed in a manner similar to that employed for the hip/shoulder index. Table 4 gives the numerical results, while graphic portrayal of the age progression in means for each sex is made in Figure 4.

Since data for transverse diameter of the thorax were not secured on the group of newborn infants, an estimate of the hip/chest index at the end of the fetal period was obtained from mean dimensional values given by Scammon and Calkins (9). These authors present means for full-term fetuses of 7.9 cms. for bi-iliac diameter of the hips and of 10.3 cms. for transverse diameter of the thorax at the xiphoid level. The ratio of the former to the latter indicates that the hip/chest index lies in the vicinity of 77 at the close of prenatal life.

It is found that:

1. A decided modification in trunk proportion, as evidenced by the hip/chest index, occurs between the close of prenatal life and the sixth postnatal year. Whereas bi-iliac diameter of the hips is estimated to approximate 77 per cent of the chest width at ten fetal months, by six years of age the hip width exceeds the chest width.
2. During the first six months of postnatal life there is a rapid acceleration

TABLE 4  
Bi-iliac Diameter of Hips in Percentage of Transverse  
Diameter of Thorax at Xiphoid Level\*

Mean Age Year Month	Cases	Mean	Standard Error of Mean	Standard Deviation	Range
Males					
3	85	87.2	.60	4.82	79.7 to 104.4
6	109	89.3	.57	5.99	76.8 to 107.9
9	136	89.1	.46	5.34	77.0 to 103.1
1 0	152	88.8	.45	5.50	75.6 to 103.2
1 3	141	88.5	.40	4.73	76.6 to 100.8
1 6	118	88.7	.42	4.54	77.0 to 99.4
1 9	103	89.6	.45	4.57	78.4 to 100.6
2 0	109	91.2	.45	4.74	82.0 to 102.4
2 3	101	92.1	.43	4.31	79.8 to 100.6
2 6	94	93.1	.44	4.23	84.9 to 103.9
2 9	97	94.0	.54	5.07	83.7 to 109.3
3 0	113	95.0	.46	4.92	83.9 to 109.2
3 6	108	95.9	.44	4.52	83.1 to 107.8
4 0	102	96.7	.52	5.23	82.3 to 111.0
4 6	100	97.6	.49	4.92	84.5 to 111.4
5 0	103	98.1	.49	5.02	86.3 to 111.8
5 6	110	99.9	.59	6.18	84.8 to 119.4
6 0	101	101.2	.65	6.50	86.7 to 120.6
Females					
3	51	86.9	.78	5.56	76.7 to 98.6
6	106	90.4	.58	5.99	75.6 to 107.5
9	117	89.9	.51	5.50	75.3 to 105.4
1 0	119	89.6	.62	5.63	74.7 to 103.0
1 3	108	89.2	.45	4.65	76.5 to 99.4
1 6	97	91.2	.44	4.34	77.7 to 100.7
1 9	87	91.4	.54	5.05	76.4 to 103.8
2 0	74	92.3	.59	5.03	80.6 to 105.3
2 3	76	93.3	.58	5.05	83.4 to 107.3
2 6	68	95.0	.57	4.67	84.4 to 105.5
2 9	66	96.5	.60	4.89	86.2 to 106.7
3 0	66	96.9	.57	4.62	86.1 to 109.5
3 6	75	98.4	.57	4.95	87.8 to 111.3
4 0	76	98.8	.52	4.53	87.5 to 110.9
4 6	83	99.8	.49	4.47	91.4 to 109.3
5 0	93	100.6	.50	4.86	90.5 to 111.8
5 6	91	101.3	.53	5.05	88.7 to 115.3
6 0	88	102.3	.55	5.16	92.4 to 118.1

\*The basic data are measurement values for Iowa City males and females of northwest European descent.

for bi-iliac diameter in percentage of chest width at the level of the xiphoid. From the estimated value of 77 for the index immediately before birth, the mean indices have risen to 89.3 for males and 90.4 for females. The major portion of this rise occurs during the first half of the interval.

3. The mean hip-chest index shows a slight decrease during the latter part of the first year. For both males and females the amount of the decline is less than one index point.

4. For the age interval beginning early in the second year and extending through to six years, each series of means gives a progressively rising trend. For females, the ascent is from 89.6 at one year to 102.3 at six years. For males, it is from 88.5 at one year, three months to 101.2 at six years. The increase over the five-year period is thus found to be 12.7 for each sex.

5. There is a consistent sex difference in mean hip/chest index. Over the entire age interval from three months to six years, each successive mean for males is from 1 to 2.5 per cent less than the mean for females at a corresponding age. The differences are statistically significant at one year, six months; two years, nine months; and three years, six months.

6. An interval of one year is found between the age at which hip width equals chest width in males and females. For females, the hip/chest index approximates 100 at four years, six months, while for males this figure is not reached until five years, six months.

It will be recalled that Freeman (6) found the chest/hip index to increase from around 109 at one day of age to 113 at one year, and then to decrease steadily to 98 at six years. When converted into the form hip/chest, these mean indices indicate a decreasing trend from 92 at one day to 88 at one year followed by an ascent to 102 at six years. The rise from 88 to 102 over the age period from one to six years closely parallels the trend obtained in the present investigation (See Figure 4). Freeman's value at one day of age, however, is 15 per cent higher than the index of 77 for the end of the fetal period derived from Scammon and Calkins. This discrepancy is probably due to the abrupt change in the size of the thorax consequent to the establishment of respiration (9, p. 28-29, 162-171). Nevertheless, it is important that the finding of the present study for the period from the end of prenatal life to three months of age be regarded as the gross trend for this interval. Further research is necessary in order to elucidate the more temporary fluctuations in the hip/chest index during the early days of postnatal life.

#### INTERRELATION OF INDICES

##### Birth to Three Months

The four indices under study all register an abrupt proportionate increase in bi-iliac diameter during the early months of postnatal life. That is, neither stem length, leg length, shoulder width, nor chest width grows as rapidly as width of hips between birth and three months of age. This finding is striking. While it is in general harmony with the principle of developmental direction for all relationships but hip/leg, it indicates that the expansion of bi-iliac diameter is sufficiently marked to overshadow the expression of this general principle (or "fundamental pattern") and to stand out as the dominant feature of the age interval. It seems probable that the explanatory factor underlying the acceleration phenomenon for hip width lies in the survival value of narrow hips at birth.

The human process of parturition is obviously facilitated by a slowing of the growth of the fairly rigid pelvic girdle until after birth.

Further analysis of the initial rise in all indices reveals that the amount of rise is less for the hip/stem index than for the hip/leg index and less for the hip/shoulder index than for the hip/chest index. It thus appears that between birth and three months of age (1) leg length grows relatively less than stem length, and (2) bi-deltoid diameter relatively more than chest width at the xiphoid level. The former finding is confirmed by values for the hip/stem and hip/stature indices reported by Bayley and Davis (1). The latter is in line with Davenport's (5) observation that following birth there is a widening of the shoulders relative to chest width which is due in part to the release of the shoulder girdle from intrauterine pressure and in part to the more forward rotation of the glenoid fossae with age.

#### Three to Fifteen Months

During the interval from three to fifteen months two types of trend are found. The hip/leg and hip/shoulder curves show deceleration over the entire period whereas the hip/stem and hip/chest curves show acceleration to six months of age and decline thereafter.

The hip/stem index rises approximately 1 per cent between three and six months and then falls by about the same amount to one year, three months. The hip/chest index rises almost 2 per cent between three and six months and then decreases by roughly half this amount to one year, three months. The hip/shoulder index declines nearly 2 per cent and the hip/leg index 9.5 per cent during the year.

It will be noted that the trend for the hip/leg index supports the principle or law of developmental direction in that it indicates the lower extremities are growing at a faster rate than the bi-iliac diameter. The other three trends, however, fail to give evidence of conformity to the principle. While the hip/stem and hip/chest indices change but little over the interval, the hip/shoulder trend takes the opposite direction from that which the principle would necessitate.

#### Fifteen Months to Six Years

During this age span of roughly five years, each of the four indices studied follows a given pattern of growth consistently and without reversals. The hip/leg index decreases, while the hip/stem, hip/chest, and hip/shoulder indices increase in varying amounts.

That the principle of developmental direction extends into the postnatal period to at least six years of age is clearly illustrated by the steep pitch of the trends for the hip/leg index and the hip/chest index. The hip/leg index declines continuously from around 47 at fifteen months to 36 at six years. In contrast, the hip/chest index shows a cumulative increase from approximately 89 at fifteen months to 102 at six years. These changes decisively indicate that leg length is growing at a faster rate than hip width and that hip width is growing at a faster rate than chest width.

The hip/stem index increases slightly, but significantly, from fifteen months to around four years and then remains relatively constant between four and six years. Viewing this finding in relation to the findings for the hip/leg and hip/chest indices, it appears that between fifteen months and six years of age leg length grows more rapidly than stem, and stem length grows more rapidly than chest width. These proportionate changes are at no point contradictory to the principle

of developmental direction.

Finally, the rising trend for the hip/shoulder index is, in itself, in general agreement with the principle or law of developmental direction. However, the hip/shoulder trend rises less sharply (from roughly 67 to 71) than the trend for the hip/chest index. This implies that though hip width is growing at a faster rate than either chest width or shoulder width, the width of the shoulders is growing faster than chest width. Can the higher growth rate for shoulder width than for chest width be explained as due to some special characteristic of development which is superimposed upon the general principle of cephalo-caudal direction? In this connection, Davenport (5) has presented evidence to show that the position of the scapulae changes with age. He writes: "The scapulae when first well developed lie at an angle of  $60^{\circ}$ , or more, with the frontal plane, at birth about  $50^{\circ}$  and in the adult about  $30^{\circ}$ . The acromial processes thus come to project laterally more prominently." (5, p. 192, 194)

#### SUMMARY

Bi-iliac diameter of the hips is studied in relation to two major length measurements and two major breadth measurements of the body.

The data consist of approximately 3,500 observations each for bi-iliac diameter, stem length, leg length, and transverse diameter of the thorax, and 2,800 observations for bi-deltoid diameter. These data were accumulated between 1929 and 1936 from measurement of upwards of 1,000 Iowa City children.

Developmental trends extending from birth to six years of age are presented for the following body proportions: hip/shoulder, hip/chest, hip/stem, and hip/leg. Selected findings are:

1. Hip width increases in relation to each of the other dimensions studied during the period from birth to three months of age.
2. Bi-iliac diameter of hips in percentage of leg length decreases from 57 at three months of age to 36 at six years of age.
3. Bi-iliac diameter in relation to transverse diameter of the thorax increases from 87 per cent at three months to 89 per cent at six months, shows a slight decrease between three and fifteen months, and then increases to 102 per cent at six years.
4. Width of hips shows an increase of approximately 2 per cent in proportion to bi-deltoid diameter over the interval from three to six years of age. For the same age span, an increase somewhat less than this amount is registered by the hip/stem index.

The interrelation of the four indices is treated and findings are discussed with reference to the principle or law of "developmental direction."

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ENVIRONMENTAL CORRELATES OF MENTAL AND MOTOR DEVELOPMENT:  
A CUMULATIVE STUDY FROM INFANCY TO SIX YEARS<sup>1</sup>

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I. INTRODUCTION

The development of methods for the testing of young children has led to a number of studies dealing with the relationship of individual differences to factors in the environment. In the investigations of Goodenough (7), Van Alstyne (12), and others, the test scores of preschool children have been found to be positively correlated with parent's education and occupational ratings. Other studies, notably those of Furfey and his associates (5, 6), have revealed no relationship between these environmental factors and the scores of infants under one year. The present report provides a link between these discrepant findings, and has the further advantage of presenting cumulative results within a uniform, although small, sample. Its principal limitation is that of all studies which are primarily statistical-descriptive, and which lack either an experimental control of variables or an intimate analytic record of the developmental process.

2. THE SAMPLING

The group utilized in this study has figured in a series of previous reports dealing with various aspects of development, (1), (2), (3). The purpose of the main investigation, as well as the practical requirements of a study involving long-continued cooperation from parents, determined to some extent the nature of the sample which was selected. Only hospital babies were used, due to the fact that the program required information concerning the mother's pregnancy and confinement, and also involved tests of the infants during the neonatal period. The sources were two hospitals drawing their clientele from different socio-economic levels. One is a county hospital including charity cases, while the other is a private hospital where cases from all income-levels may be found.

A pediatrician (Dr. L. V. Wolff) visited the hospitals and interviewed the mothers of all new-born infants who were normal at birth and had normal delivery. During the period between September 27, 1928 and May 15, 1929 seventy-five mothers were interviewed. In order to gain greater homogeneity of sampling and to simplify the task of securing information from the parents, cases were restricted to families in which both parents were white and English speaking. They were also restricted to those who had established more or less permanent residence in Berkeley, and who could be expected to be available for cumulative study over a period of years. Of the 75 families interviewed, 59 proved to be cooperative and to meet the criteria for inclusion. The 59 families included two sets of twins, making 61 children in all, 31 boys and 30 girls. Six of the children were born in the county hospital, 55 in the private hospital.

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<sup>2</sup> From Institute of Child Welfare, University of California.

Some of the socio-economic characteristics of the sample are shown in the following tables. For purposes of comparison, the tables include distributions for a larger group of Berkeley families studied during the same period. The members of this larger sample are here designated Group A, and the members of the smaller sample, providing the principal data for the present report, constitute Group B. Group A, known as the Berkeley Survey, is representative of all Berkeley families in which children were born during the 1928-29 period.

TABLE 1

## Education of Parents: Years of Schooling

Years	GROUP A		GROUP B					
	Midparent*		Fathers		Mothers		Midparent*	
	N	%	N	%	N	%	N	%
Total	405	100.00	59	100.00	59	100.00	59	99.99
17-20	66	16.30	18	30.51	8	13.56	4	6.78
13-16	128	31.60	18	30.51	23	38.98	32	54.24
9-12	162	40.00	16	27.12	22	37.29	21	35.59
5-8	38	9.38	6	10.17	6	10.17	1	1.69
1-4	11	2.72	1	1.69	0	0.00	1	1.69
Mean	11.3		13.7		12.9		13.3	
Median	11.3		14.4		13.3		13.8	
Standard Deviation	3.7		3.6		3.1		3.4	

\* The average of years of schooling of the two parents.

TABLE 2

## Occupational Classification of Fathers (at birth of child)

Description	GROUP A Berkeley Survey		GROUP B	
	No. of Cases	Percent	No. of Cases	Percent
Total	405	100.	59	100.
Professional and Executive	91	22.5	18	30.5
"White Collar"	150	37.0	22	37.3
Students	13	3.2	6	10.2
Skilled Labor	83	20.5	7	11.8
Semi-skilled Labor	46	11.4	3	5.1
Unskilled Labor	21	5.2	2	3.4
Retired	1	.2	1	1.7

TABLE 3

## Annual Income of Growth Study Families Compared with Berkeley Survey

Annual Income	GROUP A Berkeley Survey		GROUP B	
	No. of Cases	Percent	No. of Cases	Percent*
Total	376*	100.	54*	100.
Above \$8000	6	1.3	1	1.8
\$7000-7999	3	.8	3	5.6
\$6000-6999	5	1.6	2	3.7
\$5000-5999	16	4.3	2	3.7
\$4000-4999	27	7.3	3	5.6
\$3000-3999	59	15.7	15	27.8
\$2000-2999	96	25.5	15	27.8
\$1000-1999	155	41.2	10	18.5
Below \$1000	9	2.4	3	5.6
Mean	\$2,547.63		\$2,844.61	
Median	2,020.00		2,650.00	
Standard Deviation	1,872.00		1,950.00	

\* 29 cases in Group A and 5 cases in Group B have been omitted (dependents or incomplete information). The data are for 1928-1929 (at birth of child)

TABLE 4  
Frequency Distribution of Stanford-Binet IQs at 72 Months

IQ	GROUP A		GROUP B	
	n 211	% 100.0	n 48	% 100.0
170-179	1	.5	-	-
160-169	-	-	-	-
150-159	1	.5	1	2.1
140-149	7	3.3	5	10.4
130-139	26	12.3	10	20.8
120-129	54	25.6	13	27.1
110-119	70	33.2	12	25.0
100-109	41	19.4	5	10.4
90-99	10	4.7	1	2.1
80-89	1	.5	-	-
70-79	-	-	-	-
60-69	-	-	1	2.1
Mean	118.6		123.3	
Median	118.0		123.0	
S. D.	12.6		15.6	

Table 1 shows that Group B parents have approximately two years more schooling than the average of Berkeley parents (who themselves constitute a somewhat selected group as compared with urban United States families. For a further description of the Berkeley survey group, see Burks and Jones (4) and Welch (13).) Approximately one-half of the fathers and one-third of the mothers are college graduates. Approximately two-thirds of the fathers and three-quarters of the mothers are high school graduates. Table 2 shows that three-quarters of the fathers are classed in professional and "white collar" occupations, or as students. Table 3 shows that the median annual income of the group (in 1929) was \$630 greater than in the more representative Group A of the Berkeley Survey.

Since variability is an important consideration in a correlational study, attention should be directed to the standard deviations of the sample. It might be expected that because of the criterion for selection, Group B, selected for intensive study during infancy, would prove to be a sample not only with a high central tendency but also with a restricted variability. In education of parents, Table 1 shows a standard deviation for the Group B only slightly smaller than that found for Group A. Table 2 indicates for both samples a skewing in occupational status, particularly marked in the case of Group B and resulting in decreased variability. This is not paralleled, however, by the data on income (Table 3).

Turning to measures of the children, 211 of the children in Group A and all in Group B were given numerous mental tests during the preschool period. At the age of 6 years they received a Stanford-Binet test. It is probable that familiarity with test procedures has had some effect in raising the obtained IQ's for both groups. It may be noted (Table 4) that Group B has a higher average IQ, but a degree of variability representative of what is commonly found with unselected samples.

### 3. THE MENTAL AND MOTOR TEST DATA

The program of mental testing for Group A has been as follows: From birth through 15 months the children were tested at one-month intervals with the California First-Year Mental Scale (1). From 15 through 60 months they were tested (first at three -- and later at six-month intervals) on the California Preschool

Scale I (8). At 66 months they were given a vocabulary test from the Thorndike CAVD and a series of form boards. At 72 months they were given the Stanford-Binet. At all visits, from one through 72 months, they have been scored on a series of motor tests. The motor tests for the first three years have been standardized and published under the title of "The California Infant Scale of Motor Development" (University of California Press, Berkeley, California); similar tests, involving both gross physical abilities and fine motor coordinations, have been adapted for use at later ages.

TABLE 5

Coefficients of Reliability of Mental and  
Motor Tests for the First Six Years

(Split-half correlations with Spearman-Brown correction)

Age in Months	No. of Cases	$r$ for Mental Test	$r$ for Motor Test
1+2+3	52	.84	.76
4+5+6	54	.95	.82
7+8+9	45	.94	.82
10+11+12	50	.89	.93
13+14+15	45	.85	.88
18	51	.93	.83
21	53	.83	.76
24	48	.80	.74
27	51	.88	.82
30	47	.89	.82
33	44	—*	.86
36	49	.84	.80
42	43	.92	.83
48	45	.94	.71
54	44	.96	.86
60	47	.95	.94
66	46	—*	.91
72	46	.81	.88

\* No mental tests were given at 33 or 66 months.

The reliabilities of the mental and motor tests are given in Table 5 for ages up to six years. (Group B) For the first 15 months the reliability of a single test is unsatisfactory; this difficulty has been overcome by combining the results for three successive tests.

#### 4. THE ENVIRONMENTAL DATA

The environmental data utilized here were obtained by an experienced social investigator (Miss Frances Welch) who visited the homes and interviewed the parents (usually the mother) in the first month or two after the child's birth. The information obtained includes the years of schooling of the mother and the father, the father's occupation, his earnings, the total family income, and descriptions and ratings of the house exterior, living room, home furnishings and equipment, and the neighborhood. These ratings of home and neighborhood are based upon the Berkeley Social Rating Scale.<sup>1</sup>

Table 6 presents intercorrelations of the principal environmental measures; Group B and, for purposes of comparison, a random selection from Group A, are represented. The two samples agree in indicating a substantial degree of interrelationship among the various factors considered. Husbands and wives are

<sup>1</sup> Reliability, validity, and intercorrelations of the elements in this scale are presented elsewhere, (11).

TABLE 6\*  
Inter-Correlations Between Various  
Socio-Economic Measures

GROUP A (n = 145)				
	<u>Income</u>	<u>Mother's Education</u>	<u>Father's Education</u>	<u>Occupation</u>
Composite Social Rating	.79	.56	.58	.62
Family Income		.50	.54	.68
Mother's Education			.75	.63
Father's Education				.71

GROUP B (n = 52)				
	<u>Income</u>	<u>Mother's Education</u>	<u>Father's Education</u>	<u>Occupation</u>
Composite Social Rating	.82	.37	.57	.69
Family Income		.24	.59	.70
Mother's Education			.56	.57
Father's Education				.80

\*The composite social rating is based on a sum of five 5-point ratings of house exterior; neighborhood, living room family accommodations and special equipment. In order to obtain linear regression lines, correlations for income were based on auxiliary scores in terms of the following logarithmic scale values:

<u>Scale</u>	<u>Annual Income</u>	<u>Scale</u>	<u>Annual Income</u>
1	\$ 792 - \$ 937	9	\$3060 - \$3619
2	937 - 1109	10	3620 - 4389
3	1110 - 1309	11	4390 - 5079
4	1310 - 1559	12	5080 - 6009
5	1560 - 1839	13	6010 - 7129
6	1840 - 2179	14	7130 - 8439
7	2180 - 2589	15	8440 - 10,000
			Over 10,000

Occupation was scored in terms of the Taussig rating of father's occupation.

assortatively mated with regard to educational level; higher educational level is associated with higher occupational status, higher income, and higher socio-economic rating as to home and neighborhood. The highest correlations are between income and social rating, income and occupation, and father's education and occupation. From these coefficients, of course no inferences can be drawn as to direction of causation. In general, the two samples show similar values as to intercorrelation, with the exception that in Group B, mother's education tends to be somewhat less closely associated with the other variables than is the case in Group A.

An additional factor to be considered in interpreting the inter-relationship of socio-economic measures, as well as their relation to other variables, is the factor of chronological age. In Group B, the age of the father is correlated .26 with the composite social rating, and .37 with family income. Age of mother is correlated .39 and .38, respectively, with these variables, and .79 with age of father. The mean age of father (at the birth of the child) was 31.8 years, with an S.D. of 6.5. The mean age of mother was 28.4, with an S.D. of 6.2.

The factors listed in Table 6 have been combined into a total socio-economic score. The weightings of the factors are, approximately: Composite social rating, 1/3; family income, 1/4; occupation of father, 1/5; midparent education, 1/6.<sup>1</sup>

<sup>1</sup>These weightings were obtained by (a) summing the social ratings, with weighting of 1 (b) computing logarithmic scale scores for income, with weighting of 1 (c) multiplying Taussig rating of father's income by 2 (d) summing years of schooling of father and mother, and dividing by 4.

# 5. THE RELATIONSHIPS OF SOCIO-ECONOMIC VARIABLES TO MENTAL AND MOTOR STATUS AT SUCCESSIVE AGES

The different measures of socio-economic status -- parent's education, occupation, income, composite social rating, and the total socio-economic score -- have been correlated with the developmental scores of the children in Group B for all ages tested. The correlations with mental development are given in Table 7. A study of this table shows that for the first 18 months all  $r$ 's are either close to zero or tend to be negative. After this age some of the environmental factors develop a positive relation to mental scores while others remain only slightly related. Although the differences between single  $r$ 's are often not significant, the consistency of the trends for successive ages indicates that, for this particular sample, certain differences do hold. After the relationships become positive the highest  $r$ 's are with the mother's education (See Figure 1), reaching .5 at two years. Similar correlations with father's education are not found

TABLE 7

Relation of Child's Mental Score to Different Socio-Economic Measures

Age in months	N	Number of Years Mothers' Education	Number of Years Fathers' Education	Mid-Parent Educ.	Fathers' Occupation	Family Income	Social Rating	Total S.E. Scale
1+2+3	50	-.15	-.07	-.14	-.12	.12	.24	.12
4+5+6	50	-.23	-.26	-.29	-.26	-.02	.03	-.10
7+8+9	49	-.01	-.09	-.08	-.05	-.09	.06	-.04
10+11+12	47	.06	-.06	.02	.01	-.05	.07	.05
13+14+15	45	.03	-.11	-.01	-.09	-.03	.04	-.10
18	44	.12	-.10	.16	-.06	-.07	-.05	-.10
21	46	.37	.19	.29	.16	.04	.18	.15
24	41	.52	.39	.50	.35	.20	.29	.34
27	44	.47	.21	.41	.27	.10	.28	.25
30	41	.48	.33	.44	.25	.08	.19	.20
36	43	.46	.28	.47	.23	.00	.16	.04
42	37	.46	.26	.38	.30	.07	.15	.18
48	39	.50	.37	.50	.31	.11	.13	.22
54	38	.40	.39	.50	.43	.19	.12	.26
60	40	.48	.53	.58	.43	.27	.26	.36
72	42	.58	.50	.59	.38	.32	.29	.41

until the age of 5 years. Figure 2 gives the  $r$ 's at successive ages for the different items used in the total socio-economic scale. Mid-parent education is seen to be most highly related to mental scores, and family income least, with the total socio-economic score falling somewhere between in its relationship. There is, in this group, a trend toward increasing correlation between mental performance and the various socio-economic factors which have been compared; correlations with income and social rating reach a peak at about .3, and with occupation and with the total socio-economic score at about .4. It may be noted that the Stanford-Binet (at 6 years) shows on the average about the same degree of relationship to socio-economic variables as the California Preschool Mental Scale at 5 years.

Turning to the data for motor abilities, Table 8 indicates a much lower degree of relationship between socio-economic variables and this phase of development, than was found in the case of mental scores.<sup>1</sup> Correlations with mother's education, although low, are fairly consistently positive. Correlations with father's

<sup>1</sup> Correlations after 54 months have not been computed with the motor scores as there was no evidence of directional trends in relationships.

FIGURE 1  
CORRELATIONS WITH MENTAL SCORES.

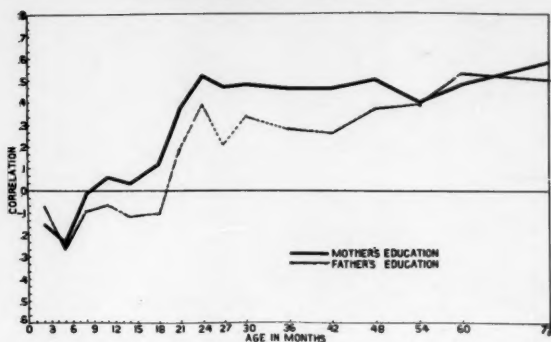
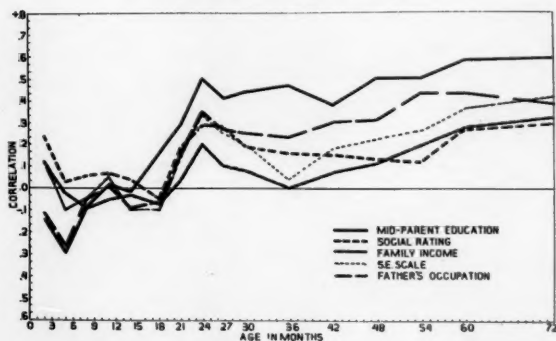


FIGURE 2  
CORRELATIONS WITH MENTAL SCORES



education, and with the family income are close to zero throughout. With the composite social rating and with the total socio-economic scale there is some suggestion of an increasing trend between 15 and 30 months, but none of the coefficients are significantly different from zero. The age of first walking and of first talking also fail to show any relation to the socio-economic variables considered here (Table 9).

As in the case of the mental scores, it is interesting to note the high incidence of slightly negative correlations with motor scores during the first year of life, suggesting the possibility of more rapid early mental and motor development among children from inferior socio-economic groups. If subsequent studies show that significance should be attached to these negative relationships, it would be interesting to explore two possible lines of explanation, (1) in terms of a biological hypothesis that within the human species as well as when human and infra-human species are compared, precocity in infant development is associated with a lower limit of development, (2) in terms of an environmental hypothesis that children from economically inferior homes tend to experience a regime more



TABLE 8

Relation of Child's Motor Score to Different Socio-Economic Measures

Age in Months	N	Number of Years Mothers' Education	Number of Years Fathers' Education	Mid-Parent Educ.	Family Income	Social Rating	Total S.E. Scale
1+2+3	50	.09	.21	.16	.26	.32	.27
4+5+6	50	-.16	-.34	-.14	.02	-.01	-.10
7+8+9	49	.08	-.19	-.01	-.12	-.02	-.12
10+11+12	47	.20	-.15	-.04	-.25	-.06	-.12
13+14+15	46	.29	-.03	.08	-.18	-.10	-.12
18	44	-.04	.01	.10	.09	.18	.12
21	46	.10	.00	.29	.09	.11	.07
24	41	.26	-.03	.11	.03	.23	.13
27	44	.14	-.13	-.02	.10	.28	.14
30	41	.17	.03	.08	.09	.25	.19
33	39	.35	.08	.21	.01	.28	.20
36	43	.22	-.01	.14	-.17	.08	.01
42	36	.12	-.14	-.03	.07	.17	.05
48	39	.15	-.09	-.04	-.11	.13	.00
54	39	.20	-.03	.12	-.14	.06	.01

TABLE 9

Correlations of Age at First Talking and Walking with Socio-Economic Variables

	Age of First Walking Alone		Age of First Saying Two Words	
	No. of Cases	r	No. of Cases	r
Mother's Education	55	-.09	53	-.22
Father's Education	55	+.03	53	.19
Mid-parent Education	55	-.04	53	-.24
Family Income	48	+.15	46	+.01
Social Rating	55	-.03	53	-.05
Total S-E Scale	53	+.08	51	-.13

stimulating to motor-adaptive behavior, while children from superior homes are in infancy more sheltered and cared-for and have less incentive for independent action.

Of the correlations presented in Tables 7, 8, and 9, the highest are those between parent's education and the children's mental performance. In accounting for this relationship, consideration must of course be given to both educational and genetic factors. Similarly, the increase in correlations, from one to three years, may be due to the cumulative influence of educational factors, or to the delayed maturation of hereditary characteristics or to varying contributions of each. Our data cannot at present be utilized to distinguish between those nature-nurture variables, or to define their relative importance at successive ages. A possible clue to be followed in subsequent investigation may be found in the tendency for the child's mental scores to correlate higher with mother's education than with father's education. This cannot readily be explained on a genetic basis, but (in view of the greater association of the mother with the child) would be expected if the resemblance between parent and child is primarily nurtural. It is possible, of course, that the difference in correlation is a chance characteristic of this small sample. Similar results, however, have been shown elsewhere.<sup>1</sup>

<sup>1</sup>In an earlier study of the relationship of the mental test scores of parents and children, among children principally of school age, Jones (3) found slightly higher mother-child than father-child correlations. Both Goodenough (7) and Van Alstyne (12) report r's for test scores of preschool children which are slightly higher with the mother's education, though in some instances the differences are very small.

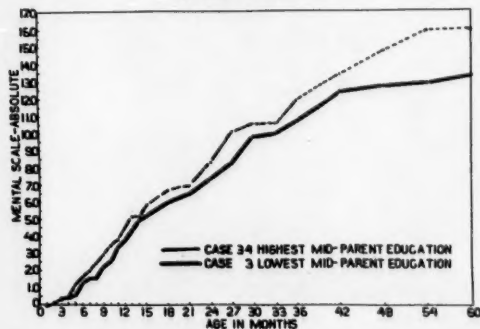
Another line of approach is through the comparison of parent-child correlations in the case of different types of mental performance; the problem here is to discover whether higher coefficients of resemblance are found in the case of abilities which are more likely to be influenced by training. One such comparison has been made on this group for tests given at five and a half and six and a half years. Three form boards (the Four-figure, Two-figure, and the Casuist) were given at these ages, and scored according to Arthur's standardization. The three scores were then summed to make a single form-board score. At five and a half years, levels A, B, C, D, E, F, and G of the Thorndike CAVD were given. At six and a half years a shortened series of the CAVD vocabulary was used -- level D, and five items from each of levels E, F, and G.<sup>1</sup>

The form-board scores correlated .45 and .33 with mid-parent education at 66 and 78 months, respectively; while the corresponding correlations for vocabulary are .33 and .39. A correlation coefficient (.41) has also been computed at 6 years between Stanford-Binet Vocabulary and mid-parent education. From these correlations, no case can be made out for a greater environmental influence on a verbal test than on a non-verbal test, although the latter would be expected to be less affected by social-cultural factors in the home.

#### 6. ANALYSIS OF GROWTH CURVE DATA

A selection was made of two groups of children whose parents have the highest and the lowest education scores in sample B. Nine children are included from the high education category, and 8 from the low education group. Figures 3, 4, and 5 present a comparison of mental growth curves for children whose parents differ most in education. Each curve represents a child's scores, obtained by the Thurstone method of absolute scaling, for each age he was tested, from month one through month sixty. In these figures the compared curves are intersecting or close together during the first 12 or 18 months, after which the child from the superior group forges ahead. By way of contrast, Figure 6 presents the mean

FIGURE 3  
INDIVIDUAL CURVES  
HIGH AND LOW EDUCATION



<sup>1</sup> As the children were unable to read, it was necessary to modify the procedure with Levels E, F, and G, and administer these tests orally.

FIGURE 6.  
MEAN CURVES OF FIVE PAIRS OF SIBLINGS

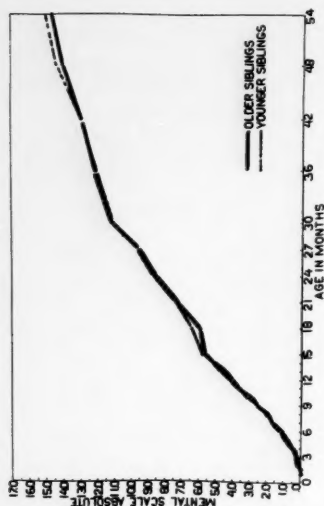


FIGURE 7  
MEAN CURVES OF 13 UNRELATED PAIRS  
MATCHED FOR MID-PARENT EDUCATION

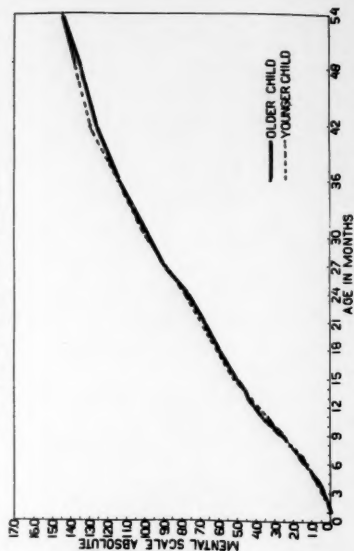


FIGURE 4.  
INDIVIDUAL CURVES  
HIGH AND LOW EDUCATION

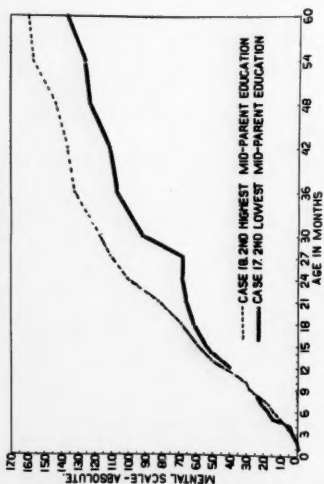
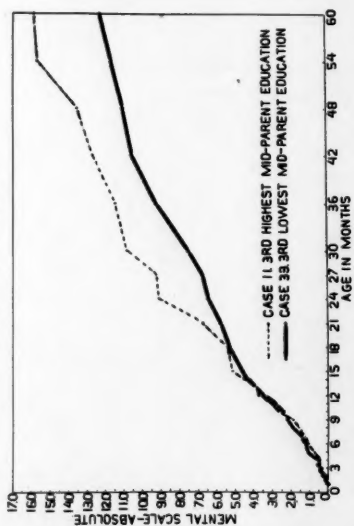


FIGURE 5.  
INDIVIDUAL CURVES  
HIGH AND LOW EDUCATION



curves of five pairs of siblings who have been studied, and Figure 7 presents the means of 13 pairs of unrelated children who have been matched for mid-parent education. In these cases, the two sets of curves are practically superimposed. The graphic data confirm the results of correlational analysis, in showing, after about 18 months of age, an increasing correspondence between a child's mental scores and the social-cultural-economic position of his home. It is obvious, however, that neither the correlations nor the growth curves can do more than present a preliminary descriptive account of relationships. We must turn to other methods if an explanation of these relationships is required, and if we are to gain a more precise prediction and control over the phenomena involved.

From previous work, the hypothesis has emerged that test performance during the first eighteen months is not diagnostic of intellectual ability. This is based partly on the greater community of function found between motor and mental scores in infancy (correlations are of the order of .5 during the first fifteen months, after which age the relationship drops markedly (2)). More directly pertinent is the fact that early mental test performance is uncorrelated with mental scores made after two years, even when a selection of the most "intellectual" items is used for comparison (2). This emphasizes the fact that the increasing correspondence between mental score and environmental variables is not necessarily attributable to the influence of the environment; it may equally well be a phenomenon of infant development, that inherited parent-child resemblances become evident only after a certain stage in the process of maturation has been reached. Evidence can be adduced in favor of each of these interpretations; the probability is that each has some validity, and that the growth of children involves both an increasing assimilation of environmental pressures and an increasing manifestation of complex hereditary potentialities. The extent to which these factors interpenetrate, and their relative importance, cannot be stated in general terms, since the answer must vary according to the function involved, the age level, and the central tendency and variability of each set of impinging factors.

#### SUMMARY

1. In a group of 59 families in which children were born in 1928-29, a social investigator collected data on parents' education, family income, father's occupation, and social-cultural-economic factors represented in the Berkeley Social Rating Scale.
2. During infancy the children of this group were given the California First Year Mental Scale monthly to fifteen months; the California Preschool Scale I was administered twelve times from eighteen to sixty-six months, and the Stanford-Binet at six years. Reliability coefficients are presented for each age level.
3. In the test group, and in a larger more representative Berkeley sample, the various socio-economic factors showed inter-correlations ranging for the most part between .5 and .8.
4. All the factors considered show zero or slightly negative correlations with mental test scores to 18 months of age. Coefficients increase thereafter.
5. The single factor showing the highest correlation with mental tests scores is mother's education, reaching a peak of .5 at two years of age. Father's education reaches a correlation of .5 at five years of age.
6. Among the socio-economic factors correlations of mental scores with

father's occupation increase to almost .4 at four and a half years; with income and with the composite social rating, correlations increase to about .3 at 6 years.

7. With a total socio-economic scale, mental scores show a correlation increasing from -.10 at eighteen months to .41 at six years.

8. A battery of motor tests was given at monthly, 3-month, and 6-month intervals from one month of age to six years. Correlations with environmental factors are lower than in the case of mental scores.

9. Motor scores tend to correlate positively with mother's education, approaching a peak of about .3 between fifteen and thirty-three months.

10. Father's education and family income show no relation to motor scores. The composite social rating shows a slight relation to motor scores, increasing from -.10 at fifteen months to .28 at thirty-three months and declining thereafter. Although probable errors are high in this material, attention is called to age trends in the correlations.

11. Age of first walking alone, and age of first saying two words, show no relation to environmental factors.

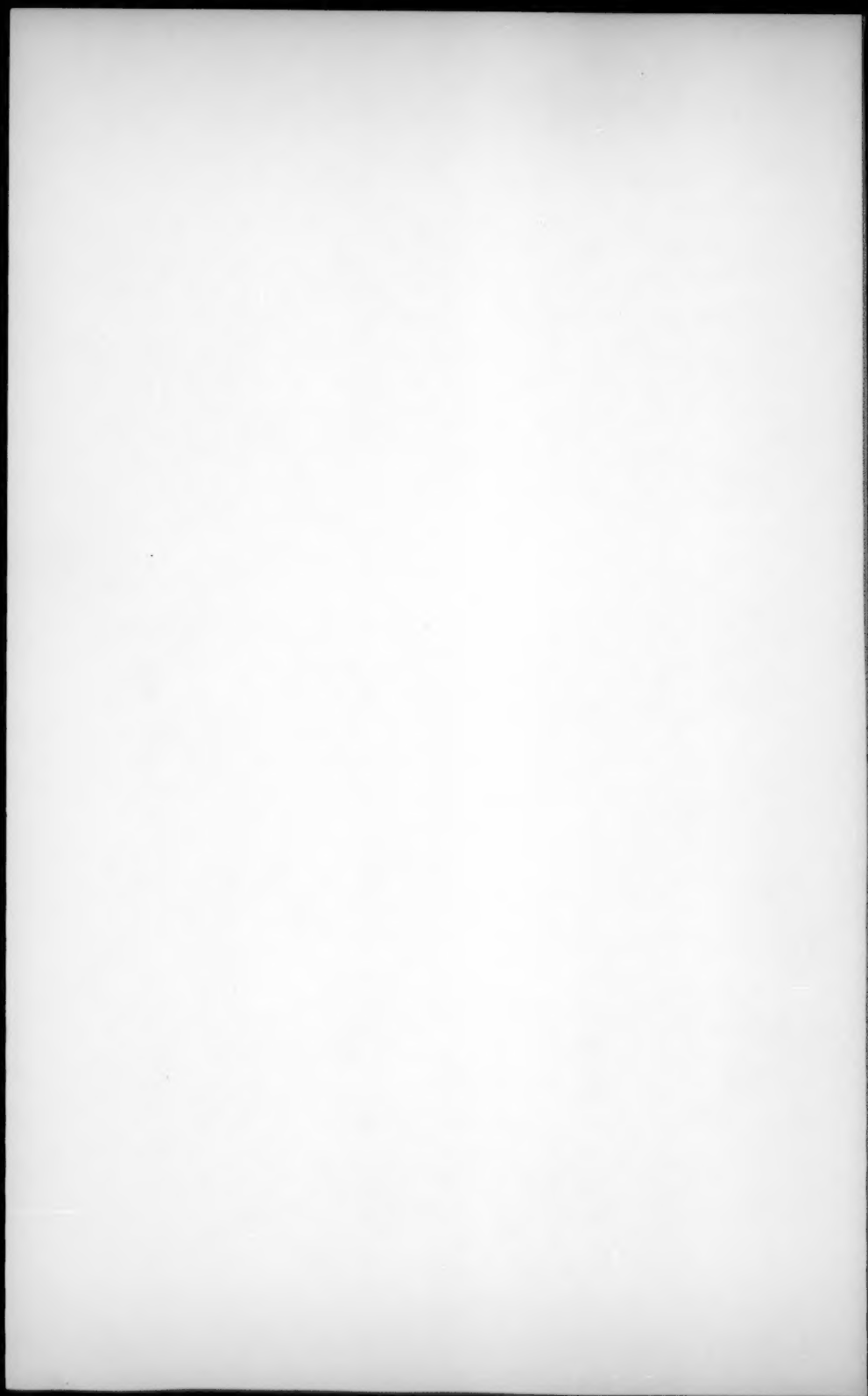
12. A comparison was made of environmental correlates for different types of mental performance. Both vocabulary scores, and form-board scores were shown to correlate about .4 with mid-parent education.

13. The correlational analysis for mental test scores is supported by individual growth data (mental growth curves in absolute units) for children from homes of contrasting educational status. Theoretical implications are discussed.

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# SEX DIFFERENCES IN BEHAVIOR OF NURSERY SCHOOL CHILDREN

LABERTA A. HATTWICK<sup>1</sup>

The old age problem "which comes first, the chicken or the egg?" appears to be no more interesting nor baffling than the question of sex differences. "Are there observable and significant differences in the behavior of boys and girls? If so, can these differences be attributed to variations in social training and attitudes or do they represent fundamental, innate differences in function or structure? These are questions which are almost as puzzling today as they were thirty years ago when research investigations on sex differences were in their beginnings.

On the latter of these two questions information is especially vague. No verifiable data on innate differences in behavior exist. We have only the belief that such differences are possible. To quote Murphy and Murphy, "Even on the endocrine evidence alone some qualitative sex differences seem beyond all doubt," (26, p. 122)

On the first of the two questions we do have a smattering of knowledge, assembled from countless studies. The majority of these studies have, in themselves, yielded negative or negligible results. It is largely because so many studies have shown the same consistent tendencies that we are justified in thinking that some sex differences in behavior do exist.

Most of the information which is available on sex differences is based upon studies of school age children or adults, upon whom social forces may have exerted a strong influence. The available data on preschool children -- in whom social factors have had considerable, but obviously less opportunity to operate -- is limited to studies which in themselves have dealt primarily with very restricted or isolated aspects of behavior.

The present investigation is based upon ratings for a wide variety of behavior tendencies in children of preschool age. A description of the data is given in the following section. The analysis of the data involved not only generalized comparison of the behavior of boys and girls, but also an analysis in terms of age level. The latter comparisons were made in the hopes that age differences in sex comparisons might throw some light on the problem of innate versus socially conditioned factors.

## Source of Data

The subject of the investigation were 283 boys and 296 girls enrolled in the Winnetka Public School Nursery and in the W.P.A. Nursery Schools of Chicago, operating under the Chicago Board of Education. A previous investigation (16) gives a partial picture of the home backgrounds of these children. The age distribution follows:

Sex	Frequency						Totals
	Age Groupings						
	2	2½	3	3½	4	4½	
Boys	10	34	74	98	52	15	283
Girls	13	40	89	93	52	9	296
Totals	23	74	163	191	104	24	579

<sup>1</sup> From Winnetka Public School Nursery.

The children were rated on a specially devised form containing 60 behavior items indicative of routine habits and personality adjustments. The items were classed under the following headings: (1) eating habits, (2) sleeping habits, (3) enuresis, (4) nervous habits, (5) speech difficulties, (6) fears, (7) reaction to adults, (8) reaction to children, (9) other reactions. Each child was rated in terms of the frequency with which a particular type of behavior had occurred in the past month: (1) "never", (2) "less than once a week", (3) "once a week", (4) "several times a week", (5) "daily or more". A particular child's score on a given type of behavior was the average of three independent judgments made by teachers in daily contact with the child.

#### Reliability of Data

A previous report (16) contains an account of the reliability and validity of the first 335 records obtained. The median reliability of these ratings (determined by comparing judgments by the same teacher on the same child one week apart) was found to be 85 per cent and the median agreement on the validity measure (determined by comparing a given teacher's judgment on a child with the average judgment of the three raters) was found to be 89 per cent.

The data were collected in two different years, the first set of records containing data on 335 boys and girls, the second set of records containing data on 244 boys and girls. The rank correlation found on the 60 behavior items for boys, when the first set of records were compared with the remaining set was  $.93 \pm .01$ . The rank correlation for girls on this same comparison was  $.92 \pm .13$ . These findings meet the usual requirements expected of reliability measures.

#### Analysis of Data

The data were analyzed separately for any occurrence of the behavior and for habitual occurrence (the latter term being used to designate behavior occurring "several times a week", "daily or more"). Critical ratios were determined only for the former analysis (any occurrence) since this contained the greater number of cases.

### THE FINDINGS

#### Behavior Characteristic of Nursery School Boys

Table 1 contains all the behavior which was found more frequently in boys than in girls. As an aid to the reader in making interpretations, the findings have been arbitrarily grouped under the headings Reaction to children, Reaction to adults, Speech habits, Work habits and Other overt behavior patterns. In the discussion a still more generalized classification has been used.

#### Aggressive Extroverted Behavior

The most outstanding characteristic of the table is the prevalence of aggressive, extroverted types of behavior. Such behavior takes several forms. It is reflected, for instance, in (1) aggressive approaches to other children, (2) negativism toward adults, (3) marked physical activity and (4) non-social behavior problems of an overt type.

In their approaches to other children boys showed more grabbing of toys and more attacking than did the girls. The differences are so close to significance

TABLE 1  
Behavior Tendencies Most Frequent in Boys of Preschool Age

Behavior	% Marked Occurrence		Occurrence to Any Degree		Critical <sup>1</sup> Ratio	Chances in 100
	Boys	Girls	Boys	Girls		
<u>Reaction to Children</u>						
*Grebs toys	.20	.12	.67	.53	2.60	99
*Attacks others	.15	.05	.60	.44	2.76	100
Refuses to share	.16	.11	.67	.60	1.37	92
Takes property	.03	.03	.32	.26	0.94	80
<u>Reaction to Adults</u>						
Refuses to Comply	.21	.15	.70	.64	1.25	89
*Ignores Requests	.32	.19	.79	.72	1.70	96
*Hard to reason	.18	.13	.58	.53	0.91	82
Resists at rest	.25	.18	.63	.60	0.58	72
<u>Work Habits</u>						
Asks unnecessary help	.22	.16	.79	.66	2.04	100
*Wastes time	.33	.26	.83	.76	1.71	96
*Leaves work incomplete	.29	.23	.83	.81	0.57	72
<u>Speech</u>						
Stutters	.06	.04	.25	.13	1.50	93
Lips, lalls	.16	.16	.39	.37	0.30	62
Slurs, speaks indistinctly	.27	.21	.52	.48	0.67	74
<u>Other Overt Behavior</u>						
Wriggles when sitting	.26	.22	.72	.65	1.46	93
*Laughs, squeals, jumps around excessively	.27	.18	.68	.51	3.21	100
*Tense at rest	.15	.10	.60	.48	2.07	98
Stays awake during nap	.19	.12	.57	.43	2.08	98
*Breaks toys	.03	.01	.34	.20	2.04	98
Temper outbursts	.06	.01	.31	.28	0.41	65
*Rushes into danger	.08	.04	.48	.27	3.21	100
*Handles sex organs	.06	.02	.34	.21	1.90	97
TOTAL CASES	283	296	283	296		

<sup>1</sup> Based on standard errors from nomographs in Dunlap and Kurtz, World Book Co., 1932, Pp. 163 (p. 17, 25)

\* These traits also showed a consistent tendency to occur more frequently in boys when analyzed at half year intervals.

(99 and 100 chances in 100 respectively) that they would in all probability be found again in a similar sampling. In refusing to share boys also exceeded the girls (92 chances in 100). In fact, in only one aspect of behavior, bossing of others, (Table 2) did girls show the more aggressive tendency. The difference here is slight, there being only 82 chances in 100 that it would be found again. It is interesting to note that bossing involves more verbal than physical direct- ing, and hence the girls' superiority in speech in contrast to boys' superiority in physical activity might explain the tendency found.

In their reactions to adults, boys were predominately negativistic. This is reflected in such behavior as refusing to comply, ignoring requests, being hard to reason with, resisting at rest. The differences are not so marked as those noted in reactions to other children. (The chances of significance are 89, 96, 82, and 72 in 100 respectively). It seems important to note, however, that the differences point to greater negativism in the boys in the case of all but one of the negativistic measures used. The exception, refusal of foods, which was greater in girls (96 chances in 100), is a doubtful item to include in this category since it has seemed, from our own experience, to be as often prompted by a desire for attention or by genuine food idiosyncrasies as by a truly negativistic attitude.

The two measures of general activity used on the present scale were "wriggles

a great deal when sitting" and "laughs, squeals and jumps around excessively." In both of these boys exceeded the girls. The more frequent tenseness at rest and staying awake at naps which was found for boys may also reflect this general tendency toward active types of behavior.

Other non-social behavior problems displayed with greater frequency by the boys include "breaks toys", "takes property of others", "rushes into danger" and has "temper outbursts". It is practically certain (98 and 100 chances in 100 respectively) that boys would show more breaking of toys and more rushing into danger in another sampling of cases. The differences between boys and girls on the other two types of behavior are slight.

At this point it seems valuable to compare the present findings with earlier investigations on sex, regardless of age levels involved. It was virtually impossible to make such a comparison for the separate items listed above, and a rather generalized comparison has therefore been attempted. On this basis, agreement is marked. Marston (22) Guilford (11) and Hendrickson and Huskey (17) definitely report more extroverted tendencies in boys than in girls. Wickman (42), Olson (30), Haggerty (12), Cornell (8), Phillips (31), Blanchard and Paynter (3), Anderson (2), Blatz and Bott (4), Mathews (24), Martens and Russ (23), Mendenhall (25), Levy (21), and doubtless many others have found more boys than girls referred for help with behavior difficulties and tend to indicate that boys are probably referred to a greater degree because their problems are of an aggressive, overt type and are hence more apparent and annoying to adults than the problems presented by girls. Snyder (37), in a study of institutionalized cases, found considerably more instances of offense against property in boys than in girls. Nelson (27) as well as many of the other authors referred to above, has found that boys display more overt activity than do girls.

Only on the question of negativism does disagreement seem to exist. The studies by Levy and Tulchin (19, 20), which are accepted and quoted most often by authorities, revealed more "resistance" in girls than boys. Reynolds (32) did not attempt sex comparisons in the study of negativism. Rust (34) found an insignificant tendency toward greater negativism in girls during mental tests. Goodenough (10) and Nelson (27), also in mental test situations, found a tendency for greater negativism in boys.

It may be that much of this apparent disagreement would disappear if we would analyze more carefully the concepts of resistant and of negativistic behavior. It seems to the writer that there is a common tendency when we think of these reactions, to picture a child who is aggressively maintaining his own - and yet when we read such a study as that of Levy and Tulchin's we find that much of the resistance (in fact the greater part of the resistance of girls) was in the form of crying and withdrawing. If we would define our terms more carefully, and include in the concept of negativism only the aggressive, defiant type of behavior then the bulk of past studies as well as the present one would seem to indicate greater negativism in boys.

#### Work Habits

Undesirable work habits such as "asks unnecessary help", "wastes time at routines" and "leaves tasks incomplete" were found to be more common in boys than girls. The chances are practically certain (100 and 96 in 100 respectively) that the first two tendencies would hold in another sampling.

These findings have some verification in previous reports. Goodenough (10)

for instance, found boys more distractible than girls (this might account for both wasting time and leaving tasks incomplete) in mental test situations. Hartshorne and May (14) found girls more persistent than boys. Nelson (27) also found an insignificant tendency for girls to be more persistent while Chapman (7) found no sex difference in persistence in eighth grade pupils. In other types of behavior which reflect on habits of work and responsibility, such as self-control, responsibility for others, and memory ability girls have also been found superior.

The inferiority of boys to girls on work habits may be another aspect of the sex differences in introversion and extroversion noted in this report. Girls, for instance, with their more subjective attitudes (see following section) are more likely to be influenced by the opinions of others and might be more conscientious in their work for this reason.

For a real understanding of the above characteristics a more detailed study is obviously necessary. "Wasting time" for instance may occur because the child enjoys his daydreaming or it may occur because the child is actively distracted by things about him. If the distinctions indicated by this study hold, we would expect the first type of behavior to occur most frequently in girls and the second type in boys. The generalized concept of wasting time used in the present report conceals these finer distinctions.

#### Speech Habits

Boys showed slight tendencies to display more stuttering, lisping or lalling, and slurring or speaking indistinctly (the only three types of speech habits rated) than did girls. This is in full accord with findings of previous investigators. To quote from the summary of the literature by Wellman "In the early years girls are clearly ahead of boys in all aspects of language and speech development. In the investigations covered there was no instance where boys were superior, although a few reported no differences. These aspects include the age of beginning to talk, size of vocabulary, length of response, comprehensibility of response, use of parts of speech, sentence structure, function of language, speech sounds and stuttering." (41, p. 631) Such general agreement seems to point rather definitely to a real sex difference in this group of traits at the preschool level. Whether these differences fade out as boys and girls reach a similar stage of maturity remains something of a question, though certain studies reviewed by Wellman (41) suggest that they persist.

#### Special Tendencies

Thirty-four percent of boys as compared with twenty-one percent of girls showed tendencies to masturbate. There are 97 chances in 100 that the difference is significant. The same tendency has also been noted by Olson (28) and Koch (18). It is rather generally recognized that the signs of masturbation in boys are more conspicuous than in girls hence that the above finding may be influenced by selective observation. On the other hand, physical structure might account for this difference just as it seems to account for the greater hair manipulation in girls. (Table 2).

#### BEHAVIOR CHARACTERISTIC OF NURSERY SCHOOL GIRLS

Table 2 contains the behavior tendencies which were most frequent in girls.

TABLE 2

Behavior Tendencies most Frequent in Girls of Preschool Age

	% Marked Occurrence		Occurrence to any Degree		Critical Ratio	Chances in 100
	Girls	Boys	Girls	Boys		
<u>Reaction to Children</u>						
*Avoids play	.12	.10	.52	.40	1.97	98
*Gives in too easily	.09	.08	.62	.55	1.30	90
*Jealous	.03	.03	.40	.27	1.88	97
<u>Reaction to Adults</u>						
*Shrinks from notice	.10	.04	.38	.34	0.66	74
*Seeks praise	.25	.14	.71	.66	1.04	84
*Stays near adult	.15	.06	.67	.41	4.50	100
*Criticizes others	.16	.09	.71	.66	1.04	84
<u>Other Withdrawing</u>						
<u>Introverted Tendencies</u>						
*Dawdles at meals	.41	.36	.78	.68	2.04	98
*Sucks thumb, day	.11	.07	.43	.31	1.69	95
*Fears strange people, places	.05	.04	.40	.33	1.04	84
*Fears high places	.12	.06	.53	.42	1.85	97
*Cries easily	.16	.15	.67	.59	1.54	93
*Avoids risk	.23	.10	.66	.57	1.73	96
*Tells fanciful stories	.05	.06	.40	.34	0.88	81
*Misrepresents facts	.04	.00	.26	.20	0.76	77
*Sulks	.15	.09	.56	.54	0.76	64
<u>Other General Tendencies</u>						
*Refuses food	.19	.13	.66	.56	1.79	96
*Twists hair	.11	.04	.57	.37	3.28	100
*Bosses others	.17	.13	.60	.55	0.91	82
<u>TOTAL CASES</u>						
	296	283	296	283		

<sup>1</sup> Based on standard errors from nomographs in Dunlap and Kurtz.

\*These traits also showed a consistent tendency to occur more frequently in girls than boys when analyzed at half year intervals.

It will be seen that the general picture here is quite the opposite from that presented by Table 1.

#### Withdrawing, Introverted Tendencies

The behavior listed in Table 2 is predominately of a withdrawing, introverted type. Whether it be in contacts with other children, in relationship to adults, or in general non-social behavior patterns this tendency is apparent.

Girls, more than boys, tend to "avoid play with other children" and to "give in too easily". There are 98 and 90 chances in 100 respectively that these differences would be found again.

In relation to adults, girls, more than boys, tend to "shrink from notice", "seek praise", "stay near adults", and "go to adults with criticism of others". The difference is significant for "stays near adults", but only slight for the other types of behavior.

No less interesting than the above findings is the fact that all but three of the remaining types of behavior which are predominant in girls are examples of withdrawing or introverted tendencies. This behavior includes dawdling, thumb-sucking, fears, jealousy, crying easily, avoidance of risk, telling of fanciful stories and misrepresenting facts. Although the differences are extremely slight, daydreaming and sulking have also been added to the table since they do reflect the tendencies just described.

Isolated findings from other studies support the tendencies listed above. Although most of the studies on jealousy -- see Foster (9), Sewall (35), Smalley (36), Ross (33), -- revealed statistically insignificant sex differences the trend



was for greater jealousy in girls. Levy and Tulchin (20), Terman (38) and others have reported girls or women more shy and withdrawing. Terman (38) and Snyder (37) have found that girls show more tendencies toward fears. Snyder (37) reports more dream life in girls. Wickman (42) Marston (22) Guilford (11) and others report more withdrawing, introverted tendencies in general in girls than in boys.

#### Special Tendencies

Twisting of hair is one of the few traits which is significantly more frequent in girls than in boys. This tendency has been noted by both Olson (28) and Koch (18). It, like handling of sex organs, is undoubtedly conditioned in part by physical structure -- i.e. girl's hair is longer and hence liable to be a more disturbing factor than is the hair of boys. Further investigation is needed to determine to what extent hair twisting is motivated by local irritation and to what extent it may be considered on a par with other so called nervous habits.

The tendency toward greater refusal of food in girls has already received comment. The general constellation of traits with which food refusals are associated seems, to the writer, to afford some evidence that this behavior is more closely allied to withdrawing or attention seeking than to the more aggressive negativistic tendencies. Data from a forthcoming study on inter-correlations between the 60 behavior items studied give further support to this supposition.

The tendency for girls to do more bossing of others than boys has also received comment. While the tendency is only slight it seems a logical expectancy in a group which has superior language development and which in general turns away from physically active types of contact. Boys in other words probably do less bossing because they manage other children in more direct physical ways.

#### Behavior Unrelated to Sex

Of all the behavior analyzed for the present report only two general types remain for discussion: (1) wetting (day and night) and (2) nervous tendencies (bites nails, chews objects, plays with fingers, picks nose, twitches, holds body tense). Neither group has revealed sex relationships.

Wetting has never stood out as a sex characteristic and seems to need no further comment. Nervous tendencies, on the other hand, have frequently been investigated for the possibility of sex differences. While the majority of studies give a faint suggestion that girls are less stable and probably more subject to nervous habits (41) than are boys, the one most thorough study of such tendencies at the preschool level, Blatz & Ringlund (5), has indicated that sex is not a factor. It seems probable that here, as in the case of negativism, we will find more general agreement after we have reached a common understanding as to what does and does not constitute a nervous trait. The findings in regard to handling of sex organs and to twisting of hair, for instance, suggest that within the now commonly accepted list of nervous symptoms differential factors are operating, and that these will need to be understood before too many generalized statements are made.

#### Age Differences in Behavior of Nursery School Boys and Girls

When boys and girls are compared at half year levels (2, 2½, 3, 3½, 4 and 4½) instead of in the broader grouping, do the above tendencies still hold? Do the differences tend to increase or decrease between the ages of 2 and 4? An age



comparison was attempted in order to provide an answer to these questions.<sup>1</sup>

Age Comparison of Behavior Showing Greater Occurrence in Preschool Boys.

In the age comparisons the following traits all tended to be greater for boys than girls at 2½, 3, 3½ and 4. (Table 3):

attacking others	laughing, squealing and jumping
breaking toys	around excessively
grabbing toys	leaving tasks incomplete
handling sex organs	rushing into danger
hard to reason with	tenseness at rest
ignoring requests	wasting time at routines

Deviations in this trend at 2 and 4½ are not significant in lieu of the small sampling of cases at these two levels.

TABLE 3

Age Differences in Behavior Stated in Table 1  
(Traits more common in Boys than Girls  
according to the total data)

% Showing Behavior				% Showing Behavior			
Behavior To Any Degree		Habitually		Behavior To Any Degree		Habitually	
Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
<u>Attacks Others</u>				<u>Laughs, Squeals</u>			
2	.60	.61	.30	2	.40	.69	.10
2½	.62	.48	.18	2½	.62	.58	.15
3	.57	.37	.16	3	.69	.55	.34
3½	.60	.47	.12	3½	.69	.49	.32
4	.60	.48	.13	4	.71	.42	.27
4½	.60	.44	.07	4½	.67	.89	.13
<u>Breaks Toys</u>				<u>Leaves Work Incomplete</u>			
2	.50	.36	.22	2	.90	.77	.30
2½	.35	.30	.03	2½	.91	.90	.50
3	.42	.26	.01	3	.89	.79	.45
3½	.34	.14	.04	3½	.81	.79	.17
4	.31	.13	.02	4	.79	.83	.21
4½	.07	.11	.00	4½	.73	.89	.07
<u>Grabs Toys</u>				<u>Rushes Into Danger</u>			
2	.60	.69	.10	2	.56	.36	.11
2½	.74	.73	.35	2½	.47	.36	.18
3	.71	.51	.18	3	.57	.21	.05
3½	.61	.46	.19	3½	.43	.28	.05
4	.65	.60	.13	4	.48	.29	.10
4½	.60	.56	.13	4½	.20	.11	.07
<u>Hard to Reason</u>				<u>Tense at Rest</u>			
2	.60	.69	.30	2	.50	.61	.10
2½	.68	.68	.21	2½	.76	.35	.21
3	.55	.52	.16	3	.53	.52	.16
3½	.54	.54	.16	3½	.61	.59	.13
4	.56	.46	.15	4	.62	.52	.14
4½	.53	.44	.20	4½	.46	.56	.23
<u>Handles Sex Organs</u>				<u>Wastes Time</u>			
2	.20	.15	.00	2	1.00	.77	.10
2½	.58	.25	.06	2½	.88	.75	.47
3	.39	.24	.08	3	.91	.75	.44
3½	.30	.20	.07	3½	.80	.77	.26
4	.40	.19	.06	4	.81	.83	.27
4½	.40	.00	.00	4½	.60	.78	.07
<u>Ignores Requests</u>							
2	1.00	.54	.30				
2½	.88	.80	.41				
3	.82	.69	.30				
3½	.75	.74	.29				
4	.75	.75	.27				
4½	.73	.67	.27				

<sup>1</sup> Due to the limited number of 2 and 4½ year olds this comparison is most valid at 2½, 3½ and 4.

Stuttering, lisping and slurring and refusing to comply were not more common in boys than girls until three years of age, but were consistently more frequent in boys than girls thereafter. Other characteristics listed in Table 1 did not reveal a consistent pattern when compared for sex differences at successive ages.

Age Comparison of Behavior Showing Greater Occurrence in Preschool Girls.

In the age comparisons the following traits tended to be greater for girls than boys (Table 4) at all levels except 2 and 4½ (levels with an inadequate sampling of cases):

avoiding risk	refusing food
avoiding play with others	shrinking from notice
bossing	sucking thumb
criticizing others	staying near adults
crying easily	twisting hair
fearing strange people	telling fanciful stories
fearing high places	seeking praise
jealousy	misrepresenting facts

Giving in too easily and dawdling were not more common in girls than boys before three. They continued to be greater in girls than boys at 4½.

Sulking was the only trait in Table 2 which revealed a more irregular pattern at consecutive age levels than those traits just described.

Seen in toto, most of the behavior listed in Tables 1 and 2 already revealed sex differences as obviously at 2 or 2½ as at 3, 3½ or 4 years of age. The differences did not vary enough between these ages to justify the belief that sex differences increase or decrease from two to four. These findings lend support, however slight, to the belief that other factors than social conditioning have helped to make for the differences in the behavior of girls and boys.<sup>1</sup>

In opposition to this point, it should be remembered that the study does not extend below two years of age and that social conditioning is known to be a potent determinant of behavior in infancy and even before birth. While this is true it must also be remembered that the child makes his greatest social strides between 2 and 4. The two year old is still a self centered individual who plays primarily alone. The 4 year old is not only significantly more interested in doing things with people but is also much more conscious of people's opinions and attitudes than is the younger child. It would seem logical to expect -- if social forces were the primary causes of these sex differences -- that such differences would become observably greater between the ages of 2 and 4.

From a purely physical standpoint, it may be that differences in speed of response or in physical prowess underlie the sex differences noted in behavior. It is recognized that boys excel girls not only in strength but also in speed of reaction -- i.e. in ability to mobilize their energy quickly. It is not difficult to see how the individual who more quickly responds to stimuli might be the more extroverted in his behavior. Certainly this possibility is worth considera-

<sup>1</sup> Neither do sex differences appearing after 2½ necessarily seem the result of social conditioning. Speech problems stand out at a later age in all probability because they are dependent upon development and regular use of language function. Refusals to comply may not stand out before three for the same reason. At least the general negativistic pattern (see ignoring requests and hard to reason with) is already more common in boys than girls at 2½ or 2.

TABLE 4

Age Differences in Behavior Starred in Table 2  
(Traits more common in Girls than Boys  
according to the total Data)

Behavior	% Showing Behavior				Behavior	To Any Degree			
	To any Degree		Habitually			Boys		Girls	
	Boys	Girls	Boys	Girls		Boys	Girls	Boys	Girls
<u>Avoids Play</u>									
2	.70	.93	.30	.23	2	.00	.00	.00	.00
2½	.70	.75	.24	.10	2½	.06	.23	.00	.00
3	.46	.56	.09	.19	3	.20	.25	.01	.02
3½	.38	.51	.08	.11	3½	.23	.27	.00	.05
4	.31	.27	.06	.06	4	.23	.31	.00	.06
4½	.40	.86	.00	.00	4½	.57	.22	.00	.11
<u>Avoids Risk</u>									
2	.50	.62	.10	.15	2	.89	.62	.44	.23
2½	.62	.83	.21	.35	2½	.53	.67	.09	.33
3	.64	.70	.12	.26	3	.63	.66	.16	.19
3½	.54	.67	.09	.20	3½	.53	.69	.08	.23
4	.62	.54	.04	.13	4	.49	.65	.14	.30
4½	.27	.56	.00	.11	4½	.57	.38	.29	.00
<u>Boases Others</u>									
2	.20	.31	.00	.00	2	.30	.23	.00	.00
2½	.32	.46	.00	.05	2½	.32	.50	.06	.15
3	.57	.52	.07	.10	3	.42	.45	.04	.09
3½	.55	.67	.15	.19	3½	.29	.28	.03	.10
4	.65	.81	.23	.31	4	.33	.35	.04	.10
4½	.80	.78	.40	.44	4½	.27	.56	.00	.11
<u>Cries Easily</u>									
2	.70	.93	.20	.15	2	.50	.38	.00	.08
2½	.71	.78	.18	.25	2½	.50	.70	.06	.20
3	.56	.67	.12	.22	3	.70	.66	.08	.21
3½	.61	.72	.14	.11	3½	.64	.73	.15	.27
4	.50	.46	.15	.08	4	.73	.89	.29	.32
4½	.53	.44	.00	.00	4½	.73	.67	.07	.22
<u>Criticizes Others</u>									
2	.50	.38	.00	.08	2	.50	.93	.10	.23
2½	.50	.65	.03	.08	2½	.44	.85	.18	.25
3	.60	.65	.07	.09	3	.45	.63	.03	.13
3½	.65	.77	.12	.21	3½	.32	.66	.02	.18
4	.86	.81	.10	.27	4	.44	.58	.02	.06
4½	.73	.78	.13	.53	4½	.33	.89	.00	.22
<u>Fears High Places</u>									
2	.22	.62	.00	.23	2	.25	.54	.00	.23
2½	.53	.65	.12	.18	2½	.36	.55	.12	.13
3	.54	.60	.08	.18	3	.40	.42	.07	.12
3½	.40	.51	.06	.08	3½	.27	.46	.07	.12
4	.31	.39	.00	.02	4	.29	.29	.06	.06
4½	.20	.55	.00	.11	4½	.27	.44	.07	.00
<u>Fears Strange People</u>									
2	.33	.62	.00	.08	2	.00	.00	.00	.00
2½	.42	.50	.06	.08	2½	.12	.33	.00	.03
3	.40	.54	.07	.11	3	.41	.38	.04	.03
3½	.36	.37	.01	.07	3½	.30	.49	.07	.04
4	.21	.33	.04	.02	4	.52	.46	.10	.10
4½	.13	.33	.00	.00	4½	.48	.33	.00	.11
<u>Jealous</u>									
2	.30	.15	.10	.00	2	.20	.54	.00	.23
2½	.18	.43	.00	.03	2½	.26	.58	.00	.10
3	.23	.33	.05	.02	3	.50	.65	.04	.16
3½	.26	.49	.02	.04	3½	.32	.54	.05	.05
4	.35	.35	.02	.04	4	.46	.58	.06	.12
4½	.40	.44	.07	.11	4½	.33	.44	.00	.22

tion, especially since the two physical characteristics just described do represent two of the more clearly established differences between boys and girls.

It is not too improbable either to consider the possibility that the traditional roles in which men and women have been placed — men as protectors, women as the weaker sex — might have left an inherent mark on the present generation.

Since extroversion seems to decrease with age (41) it might also be that the earlier maturing of girls has something to do with the behavior differences noted in the sexes. This theory might explain the disappearance of sex differences at the college level, when boys and girls are more nearly equal in terms of general

maturity.

Regardless of what the factors are which tend to make for the greater extroversion of boys and introversion of girls, the search for them would seem to be our next most profitable line of attack.

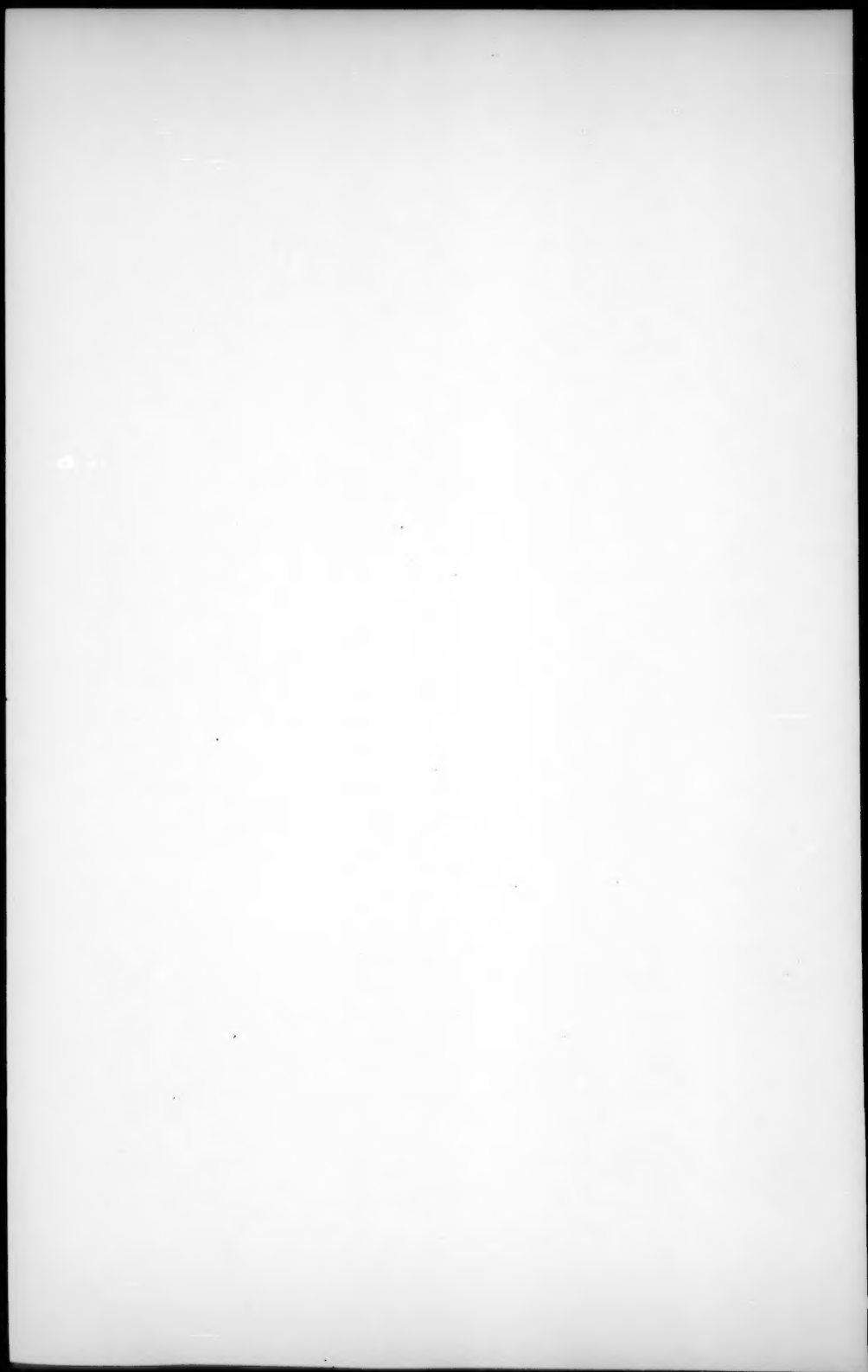
Even though we may not agree completely that sex differences in behavior exist the evidence in favor of that view would make it seem worthwhile to adopt temporarily such a premise as a basis for future research.

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## VARIATIONS IN THE INTELLIGENCE QUOTIENT OF 105 CHILDREN

H. O. O'NEILL<sup>1</sup>

The problem of the constancy of the intelligence quotient is one which is raised again and again in psychological discussions and text-books. It is generally assumed, on the basis of the Binet test, that the I.Q. remains constant from year to year except for such slight changes as may be due to differences in the physical condition of the child, his interest, the personality of the tester and the practice effect which ensues in view of the fact that the child has been tested before. When such changes occur, they are seldom progressively upward or downward but rather of a haphazard nature. Previous studies have shown that the average change in I.Q. is about five points occurring in 15 per cent of cases. It has been demonstrated, further, that when a partial organic handicap has been removed the I.Q. may rise appreciably and remain at the new level.

In an effort to contribute to these findings it seemed to us to be of value to search the annual files of the Child Guidance Clinic at the University of Pennsylvania and to make a special study of the cases which have been retested.<sup>2</sup> The testing technique of the clinic has been standardized and, in the majority of cases, the same examiner retests the child so that chance errors of a subjective nature are reduced to a minimum. The clinic, because of its staff and accessibility, handles a large number of cases every year but, as one might expect, it is the exceptional child who is most frequently referred for re-examination so that we find a larger number of children with I.Q.'s above 110 and below 90 than would happen if the group were unselected.

In the years 1934 to 1936, 1,148 cases were brought to be tested at the clinic and 105 of these were retest cases. Of the 105 cases, 87 had been tested twice, 15 cases three times, 2 cases four times, and 1 case five times. The interval between testing varies widely, the shortest span being four months and the longest six years. In the case of the former the first test was not completed because of the child's fatigue; in the latter case, the child had been diagnosed as feeble-minded on his first visit to the clinic and brought back solely for the purpose of checking the original diagnosis. The youngest child studied was one year nine months old at the time of the first examination; the oldest was eighteen at the time of the second examination. The test generally used was the Stanford Revision of the Simon-Binet. Other tests used at the discretion of the examiner were: the Kuhlmann-Anderson, the Otis Self-Administering test of Intelligence, the Thurstone and the Minnesota Pre-school test. Only cases in which the same test was used in all examinations or in which the test score was convertible into I.Q. ratings were utilized for the purpose of comparison. The basis for the selection of cases was a plus or minus variation of more than five points in the I.Q. at the time of retesting. The corresponding case-histories were then studied and an attempt made to classify and perhaps interpret the reasons for the changes.

<sup>1</sup> From Rosemont College, Rosemont, Pa.

<sup>2</sup> Acknowledgment is made to Doctor Miles Murphy, of the University of Pennsylvania Clinic, through whose courtesy the clinic files were made accessible.

In 30 cases the I.Q. was constant within 5 points  
 In 23 cases the I.Q. increased more than 5 points  
 In 36 cases the I.Q. decreased more than 5 points  
 In 7 cases no quantitative estimate is given for the first mental age  
 In 2 cases no quantitative estimate is given for the second mental age  
 In 7 cases the I.Q. fluctuated up and down

The 23 cases whose I.Q. increased more than five points may be listed as follows:

Case	Age		I.Q.		T.C.*		Factors
A	2-9	4-5	90.9	117	26.1		Excessive distractibility: age.
B	5-1	3-6-7	88.5	96.2	7.7		Dyscrasin; speech blockage.
C	3-4	3-11	85	106.3	111.4	21.3	5.1 Birth injury. Prognosis good. Intercranial hemorrhage; enlarged thymus, ataxic diplegia.
D	6-9	11-9	96	111.3	15.3		Disciplinary problem; schooling intervened.
E	4-5	7-3	85	103.4	18.4		Emotional block; schooling intervened.
F	5-3	9-5	119	139	20		Behavior problem due to home environment. More cooperative in 2nd exam.
G	4-2	5-6	96	112	16		Behavior problem. Spoiled and non-cooperative. Nursery school and kindergarten intervened.
H	5-3	9-10	71	101.6	30.6		Microcephalic. Schooling intervened.
I	7-8	8-8	73.9	82.7	8.6		Trauma as infant; severe childhood diseases. Unfavorable prognosis.
J	5-11	9-0	114	144.4	30.4		Speech mutilation.
K	4-3	7-1	88.2	108.2	20.0		Speech difficulty.
L	4-1	9-7	159	165.2	6.2		Superior child. Clinic teaching.
M	7-0	11-10	71	88	17		Speech mutilation.
N	6-6	8-11	141	159.8	18.8		Superior child. Interested in music.
P	6-1	9-10	98.6	110	11.4		Behavior problem due to lack of discipline. Schooling intervened.
Q	8-1	9-3	119.7	128	8.3		Glasses.
R	1-9	3-10	115	134.7	19.7		Age factor.
S	9-10	10-0	83.9	93.3	9.4		Myxedema. Fear psychosis. Clinic teaching intervened. Less tension at second test.
T	4-9	5-9	8-9	73	95	109.5	22 14.5 (Possibly syphilitic; lack of coordination and concentration) Helped by mother. Clinic teaching.
U	6-10	13-11	120	131.1	11.1		Unusual change upward. Nervous at time of first examination. Physically better.
V	8-11	14-7	93	105	12		Clinic teaching. Otis second time.

\* T.C. - Total Change

Case	Age		I.Q.		T.C.*		Factors
W	5-5	9-1	136.4	142.2	5.8		Familiarity with test (Examiner favorable).
X	3-2	3-10 4-11	126	143.4 152.3	17.4 8.9		Unusual educational opportunities.

\*T.C. - Total Change

Of the 23 cases whose I.Q. increased more than five points, the smallest increase was 5.1 and the largest increase was 30.6. The lowest I.Q. on the first testing was 71, the highest 159; the lowest I.Q. on the retest was 88, the highest 165.2. The distribution of the I.Q.'s on the first testing is as follows:

150-160	1
140-150	1
130-140	1
120-130	2
110-120	4
100-110	0
90-100	5
80- 90	5
70- 80	4

The ages of the children tested tend on the average to be at the lower testing levels at the first test which corroborates the conviction that the tests of young children are not as valid as those of older children. The average age of the 23 children was between 5 and 6 years.

Analysing our case records show that improvement in physical conditions would account for the rise in I.Q. in cases C, I, S, T and U. In most of these cases a favorable prognosis was given at the time of the first examination; in one case, I, the prognosis was unfavorable. The overcoming of speech difficulties was a significant fact in cases B, J, K and M. Behavior problems, with schooling intervening between the first and second tests, influenced the I.Q. in cases D, E, F, G and P. In case Q the correction of an eye defect may account for the 8.3 increase in quotient. In cases A and R the age factor accounts adequately for the improvement in the second test. Four cases, L, N, X and W are cases of superior children in whom the rise in I.Q. seems to indicate a real advancement, but even here such advantages as clinic teaching (L), or unusual educational opportunities (X) must be taken into consideration. In case V either the clinic teaching or the change in test might determine the rise. Case H with his 30.6 rise in I.Q. and case W, because of the data on his siblings, deserve special mention.

"H" is a Jewish boy, five years three months old, whose mother brought him to the clinic because she found it impossible to discipline him or keep him clean. On the Binet he made an I.Q. of 71. He was described by the examiner as being infantile in appearance and behavior and having the characteristics of an "amiable imbecile." His head girth, 48 centimeters, suggested microcephalic imbecility. It was considered at the time of the first examination that the I.Q. was a fair estimate of his intellectual capacity and that he was possessed of "innate deficiencies exaggerated by exceedingly poor home training." The mother of the child is described by the examiner as being herself an inadequate, inefficient person. The second examination of H, done when he was nine years ten months old, shows considerable improvement. His I.Q. had jumped to 101.6, his school report (4 B

grade) showed his work to be fair and his conduct good. It might seem that this case is clearly one of misinterpretation of ability added to better discipline, but it is complicated by the picture of his brother whose I.Q. decreased 18.5 points and who will be discussed later in this paper.

"W" is one of five children, all of whom had been studied at the Pennsylvania clinic. A comparative profile made in 1934 of the siblings is of interest.

	William	Robert	Peter	Ethel	Stephen	Virginia
Age-Birth date	17 yrs. July, '17	14 yrs. Nov., '19	12 yrs. Oct., '21	10 yrs. June '24	9 Yrs. Oct., '25	4 yrs. April, '29
Grade in school	College freshman	10th	8th	5th	4th	Not in school
Psychological Data						
B.S. I.Q.		(Otis) 102	124.6	98.5	142.2	123.6
Personality	Serious. Dominant. Self-suffi- cient	Conscien- tious. Sensitive. Holds to own opinion	Self- confident. Precise	Quiet	Spoiled. Cooperative. Agreeable	Sweet- Shy. Cooperative
Interest	Printing. Passing in- terest in law	Mechani- cally mind- ed. Inter- est in music. Sings	General interest in school work	Interest in writ- ing espe- cially poetry	A bit young	None yet
Diagnosis	Normal mentality. Superior to 80% of boys of his age	Normal men- tality. Limited ability. In- ferior to others	Normal mentality. Superior to 80% of boys of his age	Normal mentality. In median group	Superior to 90%	Superior to 80%

The 36 cases whose I.Q. decreased more than five points may be listed:

Case	Age		I.Q.		T.D.*		Factors
1	8-9	10-3	13.5	81.9	75.6	52.1	6.1 23.5 Polyglandular dysfunction.
2	12-3	14-3		120	111		9 Numerical decrease at 13-14 yr. level of S.-B.
3	8-9	10-11		135	129		6 Otis given second time
4	9-11	14-2		169	133		36 Socially distraught. Otis given second time. Age level.
5	4-7	9-2		142	134.5		7.5 Psychologist's estimate is that the child has improved.
6	8-3	12-8		137	130.2		6.8 Numerical decrease in upper level of S.-B.
7	10-1	10-5	14-7	119	116	105	3 11 Constitutional difficulty. Lack of motivation.
8	4-9	5-9		89.4	72.4		17 Maternal thyroidectomy. Child had rickets and feeding difficulty.
9	7-11	9-11		50.5	40.7		9.8 Feeble-minded child. Meningitis at 15 mos.
10	4-8	8-8		128	107.6		20.4 Possible lack of persis- tence.

\*T.D. - Total Decrease

Case	Age		I.Q.		T.D.*		Factors
11	2-4	4-4	128.6	107.1	20.9		Hyper-manic type. Feeding problem.
12	3-5	4-9	126.8	112.3	14.5		Temper tantrums.
13	6-10	7-0	53.6	47.6	6.0		Birth injured. Spastic paralysis. Feeble-minded.
14	9-1	13-6	109	99.3	9.7		Numerical decrease at 13-14 yr. level of test.
15	4-10	7-1	139.6	127.1	12.5		Tests given 5 yr. old are too easy.
16	6-4	10-0	55.2	46.7	8.5		Feeble-minded. Probably tubercular glands.
17	4-5	10-7	121	96.8	24.2		Pneumonia, chorea, defective eyesight, malnutrition.
18	9-3	10-9	95.5	84.9	10.6		Injury at 5 yrs. Social handicap: illegitimate, colored neighborhood.
19	6-10	16-8	100	92.3	7.7	21.5	Test defect. Negro. (Wasserman?)
20	6-5	12-2	89	81.5	7.5		Speech mutilation.
21	4-2	5-8	160	135	25		Emotional age low. Drop in I.Q. prognosed.
22	7-8	15-8	93.5	87.2	6.3		Skull fracture.
23	6-2	9-8	89	75	14		Bad behavior habits, especially stubbornness. Test results not considered final.
24	8-3	13-9	69.7	45	24.7		Mental development stopped at 8 yr. level. Unusual. Unexplainable.
25	3-4	9-0	150	14.2	8		Phobia.
26	3-1	5-9	154	130.4	23.6		Diminution with age. Prognosed.
27	5-9	11-2	141.6	141.4	.2	6.4	Otis given last time.
28	4-8	7-4	129	119.3	9.7	9.7	Severe childhood diseases. Incipient chorea, secondary anemia. Emotionally upset, sexually precocious.
29	4-11	12-0	111	100	11		Personality difficulty. Overshadowed by sister. (Examiner dissatisfied with results.)
30	9-3	13-4	90	71.2	18.8		Family background extremely poor.
31	6-10	9-9	83	64.1	19.9		Congenital brain malformation. Hypothyroidism.
32	3-5	6-4	139	109.1	29.9		Age factor.
33	7-7	9-10	89	83	6		Speech defect. Atavistic, microcephalic. Behavior formed.
34	9-1	12-0	131	109.7	21.3		Poor memory span and poor visual imagery.
35	9-5	13-1	134.4	124.6	9.8		Test level.
36	6-9	10-5	114.8	98.5	16.3		Age factor. (see study of siblings)

\*T.D. - Total Decrease

Of the 36 children whose I.Q. decreased more than five points the smallest decrease was six and the largest was 36. The lowest I.Q. on the first testing was 50.5, the highest 160; the lowest I.Q. on the re-examination was 40.7, the highest 141.4. The distribution of I.Q.'s on the first examination was as follows:

160-170	2
150-160	2
140-150	2
130-140	6
120-130	7
110-120	2
100-110	1
90-100	4
80- 90	6
70- 80	0
60- 70	1
50- 60	3

The ages of these children tend on the average to be higher than those of the increasing group and point in some cases to an acknowledged defect in the first Stanford Revision of the Binet tests at the higher levels. The average age of the 36 children is between six and seven.

Serious physical difficulties, which have not improved, explain the lower I.Q. in Cases 1, 8, 9, 13, 16, 17, 22, 28, 29, and 32, and in three cases (9, 13, and 16) the children fell into the feeble-minded category at the time of the first examination. In the latter cases, moreover, the decrease in I.Q. (9.8, 6.0, and 8.5) is relatively small. Speech defect is mentioned in the psychologist's record as being probably accountable for the lowered quotients of Cases 20 and 34, and Case 34 is also microcephalic and a behavior problem. Test defect, that is, the numerical decrease at the 12-14 level in the first Stanford Revision of the Binet, is offered as a causal factor in Cases 2, 4, 6, 14, 19, and 36. A psychological etiology is considered important in the diminished I.Q. of Cases 7, 10, 11, 12, 21, 23, 25, 30, and 35.

In case 21 the examiner predicted a lowering of the I.Q. because of the child's low emotional age and in Cases 23 and 30 the examiner himself was dissatisfied with the results of the second examination. In Case 31 the family history is bad, and in Case 18 there are a combination of circumstances, physical injury, illegitimacy and residence in a colored neighborhood, tending to handicap the child. In Cases 3 and 27 the Otis was given the second time and the variation in I.Q. is almost within the normal range.

Case 25 has a history of nervousness and inability to sleep at night after awakening one night and seeing a burglar in his room. In Case 5 the psychologist feels that the child has improved in spite of the decrease in I.Q. This child is the only one of the whole retested group who is listed as having eidetic imagery. In Cases 15, 26, 33, and 37 the examiner considers the tests at the lower level to be too easy and in Case 26 he predicted a future decrease in these emphatic terms: "the relative superiority of this child will diminish with age."

Case 3, which showed the greatest change in I.Q. in the decreasing group, is that of a Jewish girl who has special ability in language and writes fairly good poetry but is extremely neurotic and introverted and seems unable to make a

satisfactory social adjustment. Cases 35 and 36 are siblings to Case W and are included in the profile studies given previously.

Eight cases had I.Q.'s which moved up one time and down the next or vice versa.

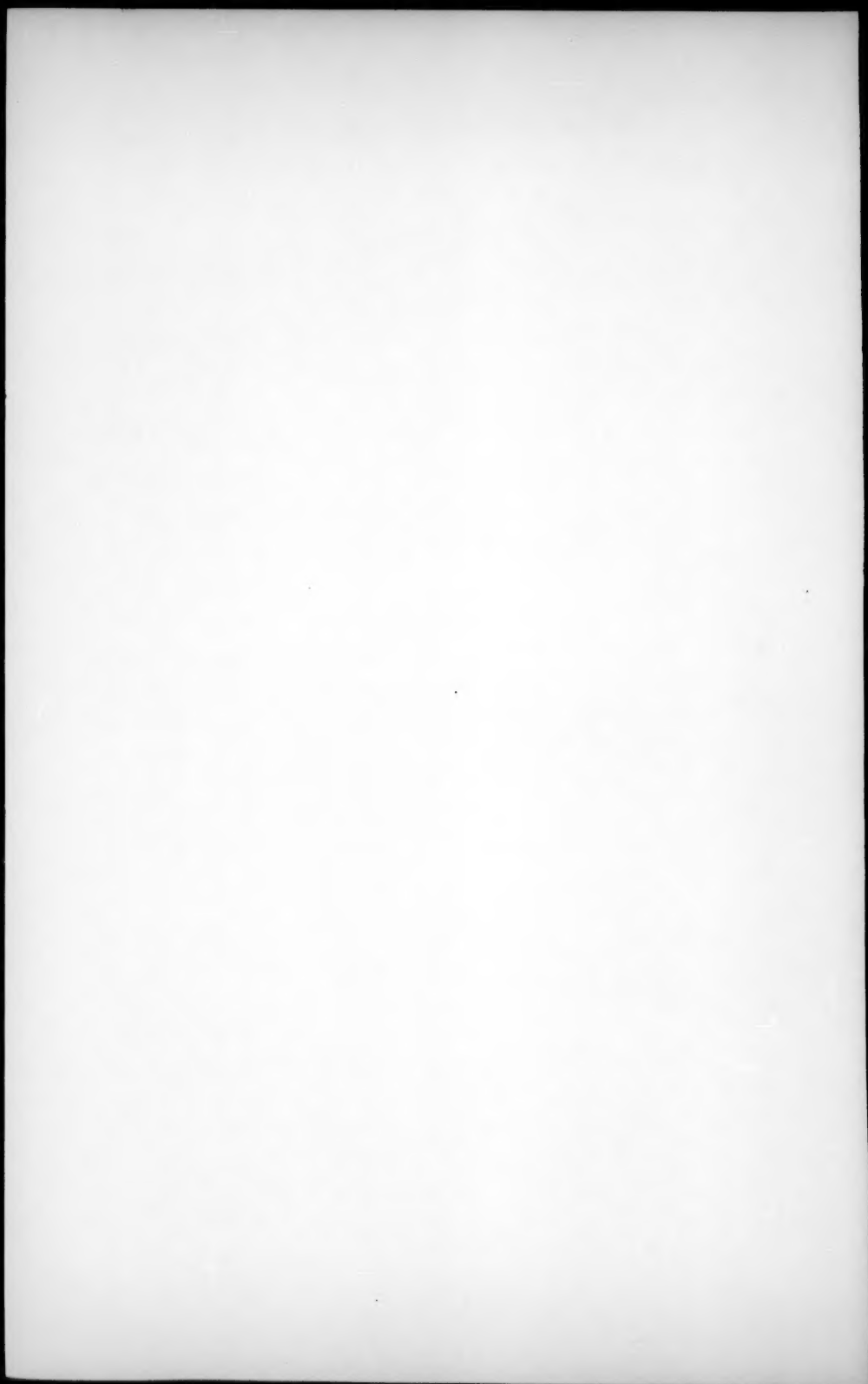
Case	Age	I.Q.	T.C.*	Factors
a	4-6, 6-4, 9-5	100, 95, 105.3	-5, +10.3	Poor cooperation and emotional instability in earlier tests.
b	5-9, 7-0, 8-12 10-12, 13-4	116, 110.7, 113.2 113.1, 118.7	-5.3, +3.5 -1.1, +5.6	Normal range of elevation.
c	4-10, 5-9, 6-9	138, 145, 138	-7, +7	Myxedema and eye corrective trouble treatment.
d	7-4, 9-3, 14-2	114, 106.3, 108.8	-7.7, +2.5	Lacks intellectual motivation.
e	4-7, 9-4, 13-11	92, 105.3, 86.8	+13.3, -18.8	Moral imbecile, lack of consistent discipline.
f	9-7, 9-8, 9-10 13-7	57.4, 54.3, 66, 52.7	-3.1, +11.7, -15.3	Peeble-minded Emotional instability.
g	9-11, 12-11, 13-7	88, 90.3, 79.7	+2.3, -8.3	Mental deterioration with oncoming adolescence.

\*T.C. - Total Change

The above group of cases are not particularly striking, but one case "e" deserves mention. He is the sibling of the microcephalic child "H" whose I.Q. increased in successive testings.

It would seem after a careful examination of all the cases listed that increase, decrease and fluctuation in I.Q. is dependent on a combination of causes and not on any one dominant factor. Physical and psychological abnormalities play an important role in changing intelligence quotients, while age and test defects run a close second.





## MINOR STUDIES ON SIGHTING PREFERENCES

BLAKE CRIDER <sup>1</sup>

The purpose of this study was to see to what extent a number of conditions were related to the eye preferred for unilateral sighting, commonly called eye dominance. The conditions studied were: 1) Distance of the eye from the point sighted; 2) the effect of the hand used in holding the sighting object; 3) visual acuity and eye closure facility; 4) sex, and 5) intelligence.

The subjects used were children ranging from six to twelve years of age. The tests were commonly used tests of eye dominance which required the child to sight at an object, such as pointing, looking through a ring, aiming, looking through a conical tube and so on.

I. A common procedure in testing for the dominant eye is to have the subject point at the examiner's nose. It was noticed that the distance the examiner stood from the child differed from examiner to examiner and from time to time by the same examiner. Does this variation make any difference?

Three different tests were used. Each test was repeated twice: once with the test object three feet away and once twenty feet away. The first test required the child to look through a hole punched in a square of cardboard. Only six children out of 222 changed eye on change of the distance of the fixation point. Permitting the same children to sight through a ring fixed at the end of a holder resulted in only five changes of eye preference with change of distance. Distance of the fixating object therefore does not seem important.

II. William James said that with the left hand we point over the left eye and with the right hand we point over the right eye. (1) Was James right? In the test requiring the subject to sight at an object through a ring we used 717 children, each child sighting once with the right hand holding the ring and once with the left hand holding it. Only fifteen subjects out of the 717 sighted with the left eye with the left hand and the right eye with the right hand. The hand used in the sighting operation does not seem to be important in determining eye preference.

III. The editor of the American edition of Helmholtz's Treatise on Physiological Optics holds that "Nearly everybody has a dominant eye which governs the other eye and in which the vision is superior to that in the other eye." (2). We have not found that statement true.

In a group of 657 subjects we found 66 who had a difference in the acuity of the two eyes yet neither eye had better than 10/10 vision as determined by the Snellen chart. Each of the 66 subjects was given an opportunity to sight 13 times and those sighting all 13 times were considered to have a definite eye preference if they used the same eye each time. If we take the group thus being classified as having a dominant eye we find 28 subjects, one-half of whom had the right eye weaker than the left eye and one-half had the left weaker than the right. We have 14 subjects with a definite left eye preference. Eight had the right eye weaker and six had the left eye weaker.

<sup>1</sup>From Cleveland, Ohio.

Visual acuity as herein measured does not seem to be related to the dominant eye. Actually our data show that children having 1/10 vision in one eye and 6/10 in the other will sight with the weaker eye. This does not necessarily mean that a visual defect does not influence the sighting eye. Our data merely indicate that by knowing the eye with the greater visual efficiency we are unable to predict which will be the sighting eye.

In our practical problems of sighting, such as aiming a gun or looking through a telescope, the usual procedure is to close one eye and aim with the other. Most people report that one eye is more readily closed than is the other. Those who do not report this experience nevertheless show by their facial muscles that one eye is much more easily closed than is another. We found 57 children who had a difference in the visual acuity of their eyes and who showed that one eye was more easily closed than the other. Thirty-one of these children saw better with the right eye but 67.74 per cent closed the left eye. In the case of the 26 subjects with the more efficient left eye only 38.46 per cent closed the right eye. Eye closure preferences therefore are not highly related to visual acuity differences.

IV. In our study we had 250 boys and 386 girls who had made at least 13 sightings on the various tests. We arbitrarily considered definite eye preference occurring where the child sighted all 13 times with the same eye. Any variation from this consistency was considered impartial eyedness. The results appear in Table 1.

TABLE 1

Percentage of Eye Preference According to Sex						
Sex	R.E.	P.E.	L.E.	P.E.	I.E.	P.E.
Boys	50.77%	1.71	21.50%	1.41	27.73%	1.54
Girls	44.57	1.79	22.28	1.50	33.15	1.70
Diff.	6.20		.78		5.42	
P.E.d.	2.47		2.06		2.29	
D/P.E.d	2.51		.38		2.37	

There is no indication from these data that eye preference is related to sex differences.

V. Intelligence quotients were available for 517 children who also had made thirteen sightings. Approximately fifty per cent of these quotients were obtained from the Stanford Binet and the others were from commonly used group tests. The mean intelligence quotient was computed for three eyedness groups and the results appear in Table 2.

TABLE 2

The Mean Intelligence Quotient for Three Eyedness Groups				
Eyedness	Mean	S.D.	P.E.m	N
Right	113.16	14.39	.59	275
Left	112.46	13.60	.71	127
Impartial	115.63	14.49	.91	115

These data indicate there are no significant differences in the intelligence of groups divided according to eye preference.

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## A COMPARATIVE STUDY OF MOTOR ABILITIES OF NEGROES AND WHITES

ADELE RHODES<sup>1</sup>

This study had a three-fold purpose: (1) to establish tentative norms of motor abilities of negro children; (2) to compare the motor abilities of negro children with those of white children; (3) to compare the motor abilities of both groups of children with groups of adults of both races.

There is little material dealing with the motor abilities of children. The study most directly related to the present one is by Goodenough and Smart (1). From results of a series of tests given to 154 children from 2½ to 5½ years of age, these investigators concluded that scores improve with age, sex differences are very small, reliability coefficients are high and intercorrelations between the tests are low. The first group factor present in all the results was tentatively described as general motor maturity, a second group factor appeared to be related to carefulness or attentiveness. Other investigators dealing with different phases of motor ability have agreed in finding a marked increase of motor control with age, but findings in regard to sex differences vary with the test used.

In the psychological studies of race, more attention has been paid to intelligence than to anything else. Klineberg (2), however, studied negroes and whites on performance tests, concluding that these tests measured mainly speed differences, which in turn were conditioned by environmental factors. Peterson and Lanier (4) gave speed tests of varying complexity to white and negro college students. They concluded that the degree of white superiority varies directly with the complexity of the performance. Lambeth and Lanier (3), testing thirty 12-year-old boys of each race, stated that since the whites do not excel in all types of processes, it is misleading to speak of "speed" differences in general. The main conclusion of the few experiments in which racial differences in motor abilities have been studied is that the negroes seem to be equal or superior to the whites. However, the number of such studies has been small and, as far as the writer is aware, none has dealt with young children on whom the influence of the social milieu has had a shorter time to operate.

The subjects for the present investigation were 80 negro children, 20 in each age group between two and five years old; also two groups of adults, 24 negroes and 20 whites, all university students. For purposes of comparing the negro children's scores with those of white children of the same ages, the figures obtained by Goodenough and Smart (1) were used.

The negro children were given four of the motor ability tests used on the study just cited: the "walking path," the needle-threading test, the three-hole test, and the stylus tapping test. For more detailed descriptions of these tests and of the procedure used in administering them, the reader should refer to the article by Goodenough and Smart. All the children were tested in the gymnasium of the Phyllis Wheatley Settlement House in Minneapolis. Two trials were given on each test. The total time required for testing each child was about 15 minutes.

<sup>1</sup> From the Institute of Child Welfare, University of Minnesota.

Table 1 shows the mean scores and their standard deviations on the separate tests for each of the four age groups, sexes being combined. As was to be expected, the scores improve steadily with age, except in two instances: the time required for walking the path by the  $2\frac{1}{2}$  year-olds and the number of stylus taps made by the  $5\frac{1}{2}$  year-olds. The  $2\frac{1}{2}$  year-olds walked fast, but seemed not to be aware of the errors they were making. A similar tendency was noted by Goodenough and Smart.

TABLE 1  
Means and Standard Deviations from the Means on Five Motor Ability Tests for White and Negro Children in Four Age Groups, and for White and Negro Adults

Age and Race	Number of Cases	Walking Path				Needle Threading		3-Hole Test		Stylus Tapping	
		Time		Errors							
		M	SD	M	SD	M	SD	M	SD	M	SD
Negro children											
2½	20	20.4	3.5	19.5	1.9	103.5	40.2	Not given		102.8	13.1
3½	20	28.9	9.5	14.0	6.7	56.3	17.1	32.7	7.5	133.0	12.6
4½	20	21.5	4.3	6.0	3.3	34.2	15.3	37.5	11.6	156.2	18.6
5½	20	19.5	4.6	3.1	1.2	24.6	8.1	51.1	12.5	151.6	18.5
White children											
2½	20	22.7	5.4	23.7	10.6	122.4	113.2	Not given		103.5	26.4
3½	24	31.5	18.8	13.1	8.5	59.2	50.9	36.7	9.9	136.1	19.2
4½	30	24.1	11.8	6.0	4.7	50.5	28.4	46.2	10.6	154.0	36.3
5½	80	21.7	9.4	3.1	2.3	32.8	17.4	56.2	11.1	151.5	27.3
Negro adults	24	13.2	3.1	1.5	1.1	10.5	4.3	88.8	17.5	345.8	44.6
White adults	20	14.7	1.9	1.9	1.4	10.5	2.8	88.7	9.6	346.4	56.4

Correlations between the first and second trials of the various tests range from .70 to .95 for single-year age groups. Of the 19 coefficients, all except 4 are above .85. Most of the intercorrelations between the various tests at successive ages are low, the highest being +.55.

Thurstone's method of factor analysis was applied to the results in order to see how the loadings would compare with those obtained for white children. (See Tables 2-3).

TABLE 2  
Factor Loadings for the Several Tests

	Factor I			
	Age			
	$3\frac{1}{2}$	$4\frac{1}{2}$	$5\frac{1}{2}$	Adults
<u>Negro</u>				
Speed, walking path	-.315	+.119	-.068	+.637
Fewness of errors, walking path	+.358	+.305	+.289	+.689
Speed, needle threading	+.824	+.450	+.283	+.544
Three-hole test	+.360	+.842	+.669	+.506
Stylus tapping, speed	+.650	+.332	+.335	+.746
<u>White</u>				
Speed, walking path	-.384	+.105	-.088	+.734
Fewness of errors, walking path	-.104	+.422	+.385	+.585
Speed, needle threading	+.611	+.372	+.498	+.672
Three-hole test	+.359	+.828	+.711	+.639
Stylus tapping, speed	+.546	+.340	+.330	+.731



TABLE 3  
Factor Loadings for the Several Tests

	Factor II			
	Age			
	3½	4½	5½	Adults
<u>Negro</u>				
Speed, walking path	-.263	-.338	-.110	+.211
Fewness of errors, walking path	+.251	+.309	-.268	+.033
Speed, needle threading	-.069	+.178	+.115	+.076
Three-hole test	+.687	+.131	+.275	-.019
Stylus tapping	-.615	-.118	-.326	-.161
<u>White</u>				
Speed, walking path	-.278	-.087	-.217	+.012
Fewness of errors, walking path	-.314	+.763	-.200	+.114
Speed, needle threading	-.031	+.269	+.308	+.024
Three-hole test	+.796	+.162	+.223	+.108
Stylus tapping	-.300	-.330	-.263	+.012

As in the earlier study at least two group factors appeared to be present. Inspection of the loadings for the different tests lends support to the suggestion offered by Goodenough and Smart, that the first factor may best be called general motor maturity, while the second represents something akin to carefulness or attention.

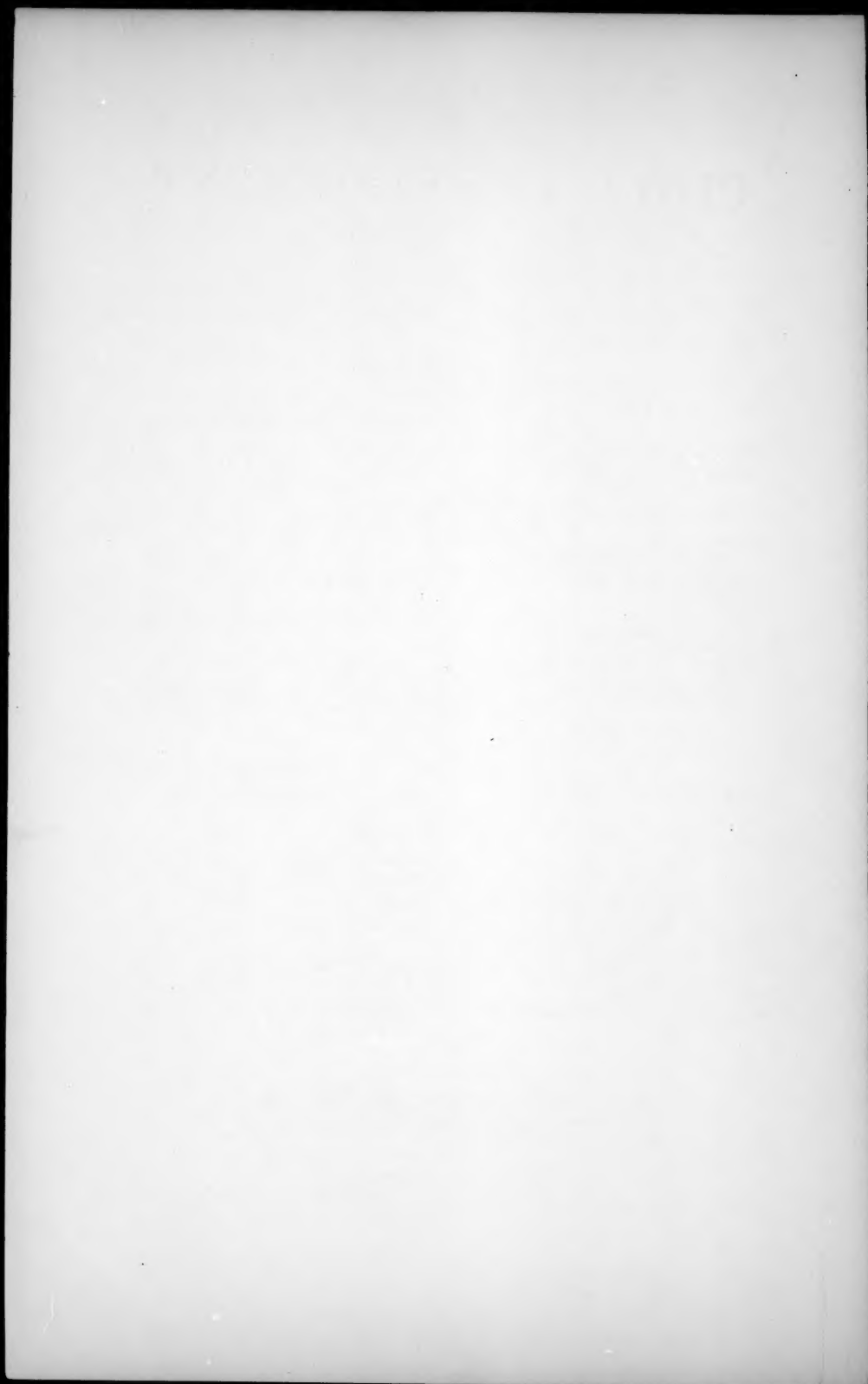
Examination of the three tables leads to the conclusion that as far as motor abilities of the kind measured by these tests are concerned, there is little, if any, difference between negroes and whites at any level of development. Considering the small number of cases studied, both the rate of motor development and the organization of motor abilities as brought out by a factor analysis are strikingly similar for the two races.

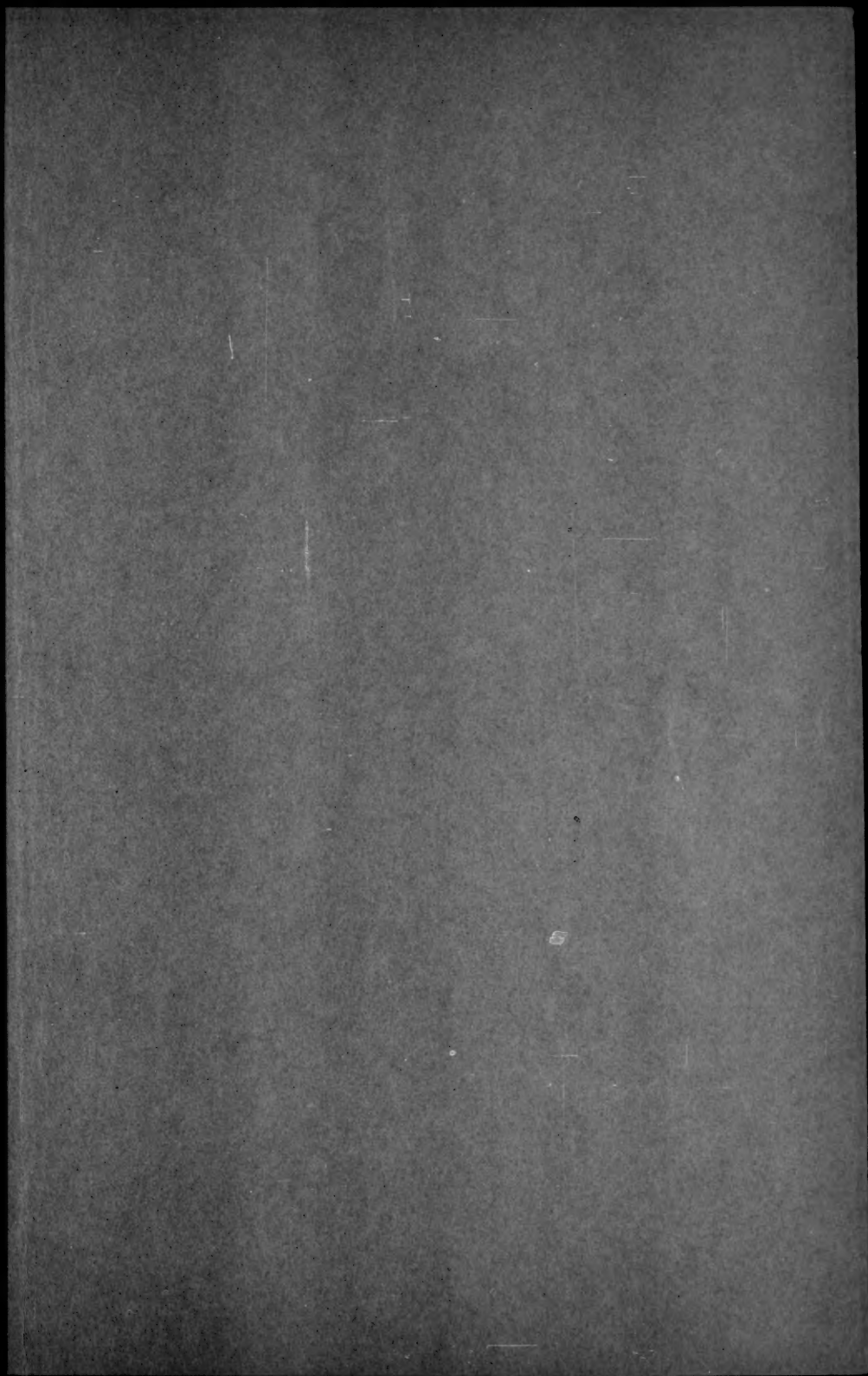
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